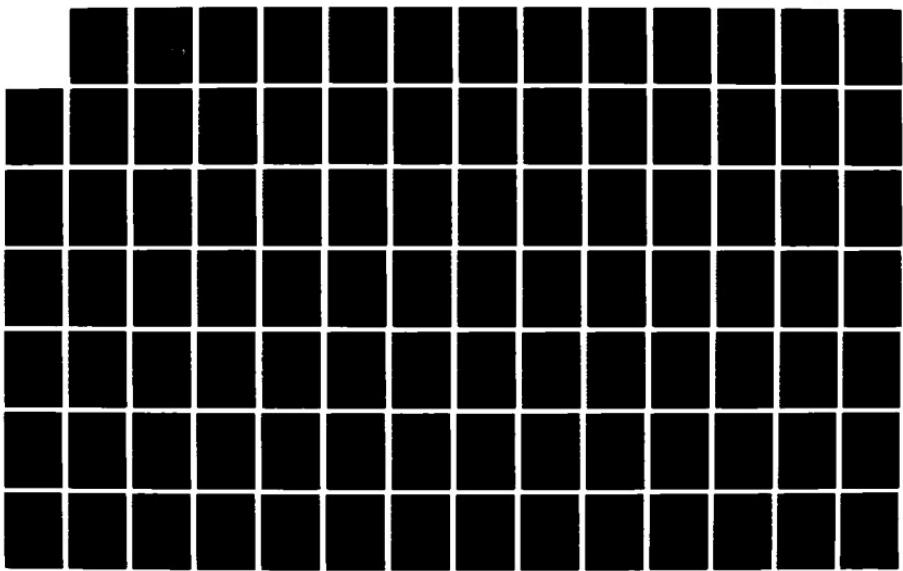


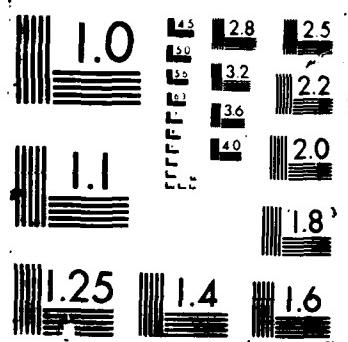
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DATA QUALITY STUDY

by

Donna A. Clark
Patricia H. Weber
Robert L. Gardner

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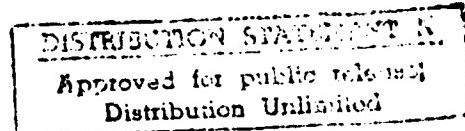
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TECHNICAL REPORT NO. 118-10

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I. INTRODUCTION

Desmatics, Inc., under Contract No. F33600-82-C-0466, is conducting an evaluation of the Communications-Electronics (C-E) subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Costs system. This report documents an investigation of the quality of data produced by the C-E system.

The C-E system, D160A, collects and displays Operating and Support (O&S) costs for items of ground communications, electronics, and meteorological equipment. VAMOSC also includes two additional systems which provide O&S cost information for aircraft weapon systems: the Weapon System Support Cost (WSSC) system, D160C, and the Component Support Cost System (CSCS), D160B. There is another subsystem called VAMOH, D160., which provides preprocessor services for VAMOSC.

Desmatics, Inc. has been engaged to provide independent validation and verification (V&V) of the C-E system. Previous Desmatics V&V efforts focused on the validity and accuracy of the cost allocation algorithms used in the C-E system. The current investigation involves identification and assessment of anomalies in recent C-E data. This study is intended to provide a background for the development of techniques for monitoring C-E system data quality, and to aid in timely identification and correction of errors in current C-E system products.

The statement of work for this task calls for Desmatics to conduct an examination of C-E system input, intermediate and output data to identify anomalous conditions; investigate the most significant anomalies; pinpoint the

source of each major problem; and recommend steps to be taken to remedy the most significant anomalies.

The following documents were used extensively throughout this Desmatics investigation:

C-E System Specification [9]
C-E System Users Manual [17]
C-E System Tutorials [8]
VAMOH Subsystem Specification [10]

Additional documents are cited throughout the text. The C-E system data files used by Desmatics are identified by file names and formats found on pages 4-2 through 4-8 of the C-E System Specification, and in Attachment C of the VAMOH Subsystem Specification.

Desmatics' study was based primarily on an analysis of FY83 C-E data. The data available for this study consisted of the 24 C-E Routine Data Base Extraction files described in Section 3-3 of the C-E Users Manual. FY83 files from the Military Personnel Center (MPC) system, E300Z, and the Accounting and Budget Distribution System (ABDS), H069R, were also available.

Using this data, Desmatics recreated some of the C-E system processing and looked in detail at intermediate files in three critical work units of the C-E system. These are: (1) Work Unit EX, which calculates costs for the five Logistics Support Cost (LSC) categories; (2) Work Unit AN, which calculates costs for most of the remaining cost categories; and (3) Work Unit AX, which builds the O&S Cost Reports from the Maintenance Cost File (built in Work Unit EX), the Cost Output File (built in Work Unit AN) and the Engineering Cost file.

The C-E system displays O&S costs for over 800 items of C-E equipment.

These equipments are identified at the Type Model Series (TMS) level. In instances where there was a large volume of information, Desmatics concentrated its efforts on three TMSs of interest to the Office of VAMOSC and the Sacramento Air Logistics Center (SM-ALC). These TMSs were:

TPN019V	Landing Control Central
TPS043E	Radar Set
TRC097A	Radio Set

Also, three organizations, identified by Personnel Accounting Symbol (PAS), were selected as representative of units which own these equipments. These three organizations were examined in some detail.

The first of these organizations is PAS WUOYFY1K, the 1st Combat Communications Group located at Lindsey AS, Germany and various other sites throughout Europe. This is a large mobile AFCC organization which owned 8 TRC097As, 2 TPNO19Vs, and 262 other TMSs which were in the FY83 TMS-NSN Table. In FY83 there were 405 personnel assigned to this organization.

The second organization examined is PAS SJODFPTB, the 603rd Tactical Control Group located at Sembach AB, Germany. This USAFE organization owned 16 TRC097As, 2 TPS043Es, and 50 other TMSs in the TMS-NSN Table in FY83. There were 317 personnel assigned to this organization.

The third organization is PAS DFOTFS9T, the 83rd Tactical Control Flight located at Davis Monthan AFB, AZ which is a TAC base. This TAC unit owned 2 TRC097As and 1 TPS043E as well as 40 other TMSs in the TMS-NSN Table. There were 92 people assigned to this organization in FY83.

The following sections of this report discuss the three major work units, AN, AX, and EX, mentioned above. Section II describes research on Work Unit EX, Section III is concerned with Work Unit AN, and Section IV discusses Work

Unit AX. In addition, Desmatics addresses two other topics: (1) the problems which arise because the C-E cost categories, as computed, are based on different equipment inventory figures, and (2) the overall efficiency of C-E system processing. These are discussed in Sections V and VI of this report, respectively. Section VII provides a summary of this study.

II. WORK UNIT EX - LOGISTICS SUPPORT COSTS

Work unit EX is composed of programs which build a series of data tables culminating in the production of the Maintenance Cost File (Table 8). This file contains costs, by TMS, for the five Logistics Support Cost (LSC) categories: Depot Maintenance, Replacement Investment, Transportation and Packaging (T&P), Base Maintenance Personnel, and Maintenance Material. In addition, the Maintenance Cost File also contains Medical and Permanent Change of Station (PCS) costs for base maintenance personnel.

Work unit EX consists of eight major programs:

- X2 - Build Reportable TMS File and Table 1
- X5 - Average Inventory Summation
- X8 - Build Table 3-4
- XA - Build Table 5
- XD - Build Table 6
- XE - Build Table 6-7
- XH - Build Table 8
- XI - Produce Maintenance Cost File.

Program X2 matches the C-E Inventory file with the TMS-NSN Table to build Table 1, which contains inventory and condemnation data. It also builds the Reportable TMS File, which provides inventory, condemnation rate and acquisition data to Program X5. Program X5 summarizes the inventory data by TMS. Program X8 matches the Summed Recoverable TMS file to the Recoverable Cost Data Base and builds Table 3-4, containing the Depot Maintenance and Replacement Investment portion of the LSC costs. Program XA builds Table 5 which contains T&P costs. Program XD uses base labor data to build Table 6,

which is then summarized by Program XE to produce Table 6-7, containing base labor and material costs. Program XH merges Table 3-4, Table 5 and Table 6-7 to build Temporary Table 8. Program XI brings in the Mobile Depot Maintenance (MDM) File and merges it with Temporary Table 8 to produce the Maintenance Cost File (Table 8).

The approach used in evaluating Work Unit EX was to start at the output stages of the major files and work back as far as possible with the data available to Desmatics. The first task undertaken was to verify the data in the Maintenance Cost File against the data from the major table files of Work Unit EX. This investigation is described in the following section. Other investigations regarding Work Unit EX are described in Sections B through F.

A. MAINTENANCE COST FILE DATA

The Maintenance Cost File (Table 8) contains the Logistics Support Cost data for each TMS costed by the C-E system. It is produced by Programs XH and XI using as inputs the Application National Item Identification Number (NIIN) Cost File (Table 3-4), the Recoverable NIIN Cost File (Table 5), the Labor and Material Cost File (Table 6-7), and the Mobile Depot Maintenance (MDM) File. The purpose of this investigation was to determine if the data in the FY83 Maintenance Cost File agreed with that in the files from which it was built.

Procedure:

Table 3-4, Table 5, Table 6-7 and the MDM file were used to build a composite file in the format of Table 8. All of the fields of this Desmatics file were then checked against the corresponding fields of the Maintenance Cost File.

Files Used:

Application NIIN Cost File - PJMXKAO (Format DIGSOP PJTAB34)
Recoverable NIIN Cost File - PJMXLAO (Format DIGSOP PJTAB05)
Labor & Material Cost File - PJMXMAC (Format DIGSOP PJTAB67)
Maintenance Cost File - PJMXIAO (Format DIGSOP PJTAB08)

Results:

The data in the FY83 Maintenance Cost File (Table 8) agreed with that in the source files from which it was constructed. Desmatics concludes that Programs XH and XI are working as intended.

B. TRANSPORTATION AND PACKAGING COSTS

The Recoverable NIIN Cost File (Table 5) includes packaged weights and allocated T&P costs for all the end items and recoverables listed in the Application NIIN Cost File (Table 3-4). Packaged weights are obtained from the 0013 Packaging and Transportation Data Maintenance System. T&P rates are supplied by the Office of VAMOSC based on information in AFLC Pamphlet 173-10

[1].

Items and recoverables that have production quantities (indicating that depot repair work was performed), or that have depot condemnations, are assumed to have been transported to a depot and back to the base, giving rise to round trip T&P costs. Condemnation of items at base level are assumed to result in one-way T&P costs caused by shipment of replacements to the base.

During Desmatics' previous validation study of the C-E T&P allocation algorithm, several problems were noted with the computation of T&P costs. First, it was observed that there were many items in Table 5 that lacked weight data for FY82. This was due to the fact that shipment data from only one depot, Sacramento Air Logistics Center (SM-ALC), was received by the C-E system. Also, some end items of C-E equipment were found to have a packaged weight well in excess of 10,000 pounds. However, the width of the packaged weight field in C-E Table 5 (and also in 0013), allows for a maximum weight of only 9999.99 pounds. Another problem with the current algorithm is the application of the packaging rate to packaged weights, rather than to unpackaged weights as intended. As a result, the C-E system seriously overstates packaging costs.

In this section Desmatics assesses the completeness of FY83 T&P data, and determines whether the C-E programs calculate T&P costs correctly. The impact of the restricted size of the weight field and the use of the packaging factor with packaged weights are also examined.

Procedure:

1. Table 5, which contains a record for each end item and recoverable pair in Table 3-4, was examined to see if any recoverables lacked weight data. These were then summarized by Federal Supply Class (FSC).
2. Records for the TPN019V, TPS043E and TRC097A were selected from Table 3-4 and Table 5. Each record in Table 3-4 was matched with Table 5 on TMS, Application National Stock Number (NSN), and Recoverable NSN. The production quantity, depot condemnations, base condemnations, and Recoverable Allocation Factors (RAF) were used to calculate T&P costs for each recoverable. In order to determine the extent to which packaging costs were overstated for FY83 when the packaging rate was applied to packaged weight rather than unpackaged weight, Desmatics used a factor of 1.941 to convert packaged weights to unpackaged weights. This Packaged Weight/Item Weight factor [1], provides an average allowance for the weight added when items are packaged for shipment. Transportation costs were calculated using packaged weights. T&P costs were then rolled up over all recoverables within the three TMSs.
3. When weights too large to fit in the packaged weight field are encountered by the 0013 system they are reported as 9999.99 pounds, thus understating the true weight. To assess the impact of this on allocated T&P costs, Desmatics looked up the weight for these end items in AFP 100-14, the Communications-Electronics Equipment Directory [5]. To determine the nature of the weights given there, Desmatics contacted the OPR (Office of

Primary Responsibility) for AFP 100-14 and was told that the weights shown there are packaged weights obtained from the manuals for the equipments.

The packaged weight given in AFP 100-14 was divided by 9999.99 and multiplied by the allocated T&P cost. The cost understatement was computed by subtracting the cost allocated by the C-E system from the costs computed by Desmatics.

Files Used:

Recoverable NIIN Cost File - PJMXLАО (Format DIGSOP PJTAB05)
Application NIIN Cost File - PJMXKAO (Format DIGSOP PJTAB34)

Results:

1. Over 2000 recoverables in the FY83 Table 5 file were found to lack weight data. In FY83, 0013 data for depots other than Sacramento ALC had not yet been included in the 0013 interface to C-E. DAR VAM D84-018 was implemented for FY84 processing to provide T&P data from additional ALCs, but this DAR also provided for screening 0013 records against a list of C-E end item Federal Supply Classes. Many C-E equipments contain recoverables with FSCs not on this list. Based on an examination of FY83 data, Desmatics concludes that T&P records from 0013 for as many as 62 FSCs may be omitted by implementation of this part of this DAR.
2. The allocated T&P costs for the three TMSs of interest were found to be significantly overstated because packaged weights were used in calculating

the packaging costs. The costs allocated by the C-E system are shown below, along with those calculated by Desmatics. The Desmatics costs were computed using estimated unpackaged weights for the packaging portion of T&P.

<u>TMS</u>	<u>C-E T&P</u>	<u>Desmatics' T&P</u>
TPN019V	\$ 72,679	\$ 41,216
TPS043E	677,795	384,484
TRC097A	466,089	264,391

The rates used in FY83 were \$.3004/lb for transportation and \$2.497/lb for packaging. Based on these ratios and assuming a Packaged Weight/Item Weight Factor of 1.941, all FY83 T&P costs were overstated by 76%. The methods used in calculating T&P costs are shown in the following two equations, where W is the packaged weight given in 0013:

$$\text{C-E System: } W \times (\$2.497 + \$.3004) = \$2.7974 \times W$$

$$\text{Desmatics: } (W/1.941 \times \$2.497) + (\$.3004 \times W) = \$1.5869 \times W$$

3. Desmatics found weights in AFP 100-14 for 17 of the 56 TMSs (58 Application NSNs) which had weights of 9999.99 pounds listed in Table 5. However, only six of these had production quantities and/or condemnations needed to compute T&P costs. These six TMSs are listed below along with the T&P costs calculated using the weights found in AFP 100-14. The T&P

costs reported by the C-E system are also given.

<u>TMS</u>	<u>Weight, lb</u>	<u>C-E T&P</u>	<u>Desmatics T&P</u>	<u>Understatement</u>
MPN013C	18,832	\$ 55,948	\$105,361	\$ 49,413
MSQ077	30,000	111,896	335,688	223,792
MSQ0T8A	20,000	111,896	223,792	111,896
TGC020	14,200	55,948	79,446	23,498
TSQ096	51,000	111,896	570,670	458,774
TTC030	10,330	279,740	337,534	57,794

In computing T&P costs for the table above, Desmatics used the C-E equation shown in the previous section rather than the Desmatics' equation given there. Thus, the table above shows only the effect of understating the weights due to the limited size of the weight field, and does not consider the problem caused by applying the packaging rate to packaged weights.

The C-E T&P algorithm is based on the assumption that items are shipped if depot maintenance production quantities are shown. However, it is possible that when depot production quantities are given for end items with large weights, the repair work may have been performed in the field, and the end items were not actually shipped to the depot. In that case, the C-E system would actually overstate T&P costs.

Recommendations:

1. VAMOH processing of 0013 data should be modified to eliminate any screening of records against a table of FSCs; otherwise weights for many C-E recoverables will be lost.

2. The packaging rate should be applied to unpackaged weights, rather than to packaged weights as is currently done. This will avoid a serious overstatement of T&P costs, and can easily be accomplished without a programming change. The packaging rate should be manually adjusted by dividing it by the current Packaged Weight/Item Weight Factor. (The factor given in AFLCP 173-10 was 1.941 for FY82.) Of course, the optimum solution would be to use individual unpackaged weights for each recoverable and end item, but there appears to be no readily available source for this information.
3. To avoid the understatement which occurs when end items weighing more than 10,000 pounds are shipped, the true weights of these items should be used. It should be possible to obtain these weights from the item managers and enter them manually into an expanded weight field. It should also be possible to determine whether or not these items were actually shipped. Although this cannot be done in the current algorithm, the Second Destination Transportation (SDT) algorithm currently under development by the Office of VAMOSC will incorporate this information.

C. COMPARISON OF FY82 AND FY83 RECOVERABLES

Information on C-E recoverables and their next higher applications is available from the D041 system. The C-E system uses information in a top-down approach to relate items to their next lower assembly. This is done for three levels of indenture.

The Office of VAMOSC has determined that the program which computed the Recoverable Allocation Factor (RAF) for FY83 did not output the complete set of recoverables for a sample of TMSs. The purpose of this Desmatics investigation was to provide some quantification of the deficiency in RAF processing.

Procedure:

Desmatics counted the number of recoverables per TMS for FY82 and FY83 in Table 3-4 and compared the two counts. These tables contain one record for each recoverable within each application NSN per TMS. Only recoverables for TMSs appearing in both years were counted. Since the composition of end items is assumed to be somewhat stable from year to year, there should be no large differences in the number of recoverables.

Files Used:

Application NIIN Cost File (Table 3-4) - PJMXKAO (Format DIGSOP PJTAB34)

Results:

1. There were 776 TMSs which appeared in both FY82 and FY83. Of these 381 (49%) had the same number of recoverables each year. However, 161 TMSs (21%) had more recoverables in FY83 than in FY82. These included

the three TMSs of special interest to the Office of VAMOSC:

<u>TMS</u>	<u>FY82</u>	<u>FY83</u>	<u>Difference</u>
TPN019V	397	583	186
TPS043E	155	234	79
TRC097A	82	167	85

In contrast, there were also 234 TMSs (30%) which had more recoverables in FY82 than FY83. Three of these with the largest differences were:

<u>TMS</u>	<u>FY82</u>	<u>FY83</u>	<u>Difference</u>
MPN014E	577	285	292
CP1256VG	173	16	157
FRR078V	196	123	73

There seems to be no consistent pattern in the year-to-year differences in the number of recoverables per TMS. This could be due to the fact that this program was designed to make use of a Program Select Code in the D041 data which has no relevance for the C-E system. C-E currently bypasses records having a Program Select Code of "0000." This bypassing of D041 records could also explain why 492 of the 842 TMSs in Table 3-4 for FY83 had no recoverables.

2. Another problem with current recoverable processing is the fact that the program screens the D041 records against a table of end item Federal Supply Classes (FSCs). If neither the FSC of the Application NSN nor the FSC of the Recoverable NSN is in the FSC Table, the D041 record is not selected. Legitimate recoverables are lost in this process, because some recoverables do not have the same FSCs as the end items in which they are used.

3. It was found that 577 (68%) of the TMSs in the FY83 Table 3-4 file did not have depot maintenance costs reported. This may be due in large part to the deficiency in the processing of recoverables.

Recommendations:

1. Steps already initiated by the Office of VAMOSC to correct deficiencies in the RAF processing should be continued. The program should be changed to eliminate the use of the D041 Program Select Code as a C-E selection criterion.
2. The table of FSCs used in processing D041 records is too restrictive, causing many C-E recoverables to be bypassed. This FSC screening should be eliminated.

D. PMI AND CORRECTIVE LABOR HOURS

The Labor and Material Cost File (Table 6-7) includes allocated base maintenance labor costs for each costed TMS. These labor costs are based on corrective manhours from D056A, and Preventive Maintenance and Inspection (PMI) hours from the TMS-NSN Table. Base labor costs are computed in Program XD based on these hours.

The Office of VAMOSC has determined that PMI hours are not processed for a TMS if that TMS has no corrective hours reported in D056A. DAR VAM DRB-1

is intended to correct this problem. When this DAR has been implemented, PMI hours will be processed regardless of whether corrective hours are present or not.

The FY83 TMS-NSN Table contains many instances of multiple records per TMS, each representing a different Standard Reporting Designator (SRD) or National Stock Number (NSN). In several cases the PMI hours in the FY83 TMS-NSN Table differ from one NSN/SRD to another for the same TMS; however, Table 8 has only one record per TMS, and thus cannot reflect different PMI hours for each NSN/SRD.

The purpose of this investigation was to determine what PMI hours were used in calculating labor costs, whether the calculations were correct, and under what conditions PMI hours were processed in FY83 data.

Procedure:

1. The FY83 TMS-NSN Table was sorted on TMS. Where there was more than one record per TMS, the PMI hours were compared. If there was a difference, the records were written out for research. The TMS-NSN Table records were then matched on TMS with the records of Table 6-7. The PMI hours from the TMS-NSN Table were multiplied by the average annual inventory from Table 6-7 to get Support General Hours. These were compared with the Support General hours given in Table 6-7.
2. Using data from Table 6-7, Support General hours were added to corrective hours for each TMS, divided by the total available duty hours for the Air Force Specialty Code (AFSC), and multiplied by the total cost for the

AFSC. The result was compared with the base labor cost given in Table 6-7.

3. An audit was made to determine if all TMSs with PMI hours in the TMS-NSN Table were in Table 6-7, and whether there were any TMSs in Table 6-7 with PMI (Support General) hours but no corrective hours.

Files Used:

Labor & Material Cost File - PJMXMA0 (Format DIGSOP PJTAB67)
TMS-NSN Table - PJMA2A0 (Format DIGSOP PJTMNST)

Results:

1. There were 23 TMSs in the TMS-NSN Table which had per-unit PMI hours differing from one NSN/SRD to another within the same TMS. The differences in PMI hours were as much as 833 hours between two NSN/SDRs of the same TMS, as shown in the example below.

<u>TMS</u>	<u>SRD</u>	<u>PMI Hours</u>	<u>Labor Cost</u>	<u>Table 6-7</u>
UPA062C	8CP	84.0	\$ 206,000	
	EVX	917.0	2,111,000	\$2,111,000

Table 6-7 showed labor costs of over \$2.1 million for the UPA062C. This was based on the 917 PMI hours per unit for the SRD of EVX. However, if the value of 84 PMI hours given for the 8CP SRD had been used instead, the allocated labor cost would have been about \$206 thousand.

It is questionable whether two SRDs of the same TMS should have such widely differing PMI requirements, but if such conditions are valid, the C-E system should be capable of reflecting them. Program XD appears to use the PMI hours of one of the NSN/SRDs for a TMS, and takes no account of PMI values given for other NSN/SRDs.

2. The labor costs computed by Desmatics agreed with the costs shown in Table 6-7 in all instances. It appears that Program XD computes these costs correctly.
3. There were many TMSs in the FY83 TMS-NSN Table which had PMI hours but were not represented in Table 6-7. This cannot be explained solely on the basis that Program XD does not process PMI hours if there were no corrective hours, because there were four TMSs in the Table 6-7 which had PMI hours but no corrective hours (AE37G1, FRC171V, SEBIT36M, and TFC101). Desmatics could find no apparent reason for this discrepancy.

Recommendations:

1. TMSs in the TMS-NSN Table having multiple NSN/SRDs with different PMI hours should be checked to insure that the PMI hours shown in the table are correct. If differing PMI hours for different NSN/SRDs with the same TMS are valid, then the program logic should be changed to compute Support General hours separately for each NSN/SRD.

2. It appears that some PMI hours are processed even when a TMS has no corrective hours. However, many TMSs with PMI hours in the TMS-NSN Table do not show up in Table 6-7. Program XD should be checked for possible errors before DAR VAM D85-002 is implemented.

E. BASE MAINTENANCE COSTS

The C-E Cumulative Base Labor file contains the base level corrective manhours received from the D056A system. For FY83 this file included fields for the four quarters as well as for the annual corrective labor hours. Program XD in Work Unit EX integrates base labor data into Table 6, but the initial processing is done in Work Unit M1. The primary function of Program M6 in Work Unit M1 is to summarize monthly labor data by SRD and pick up TMS identification from the TMS-NSN Table. Currently, Program M6 also screens each D056A record against a table of SRDs which are not reportable in D056A.

Program M3 in Work Unit M2 performs a similar function for base material records from D002A. These records are summarized by SRD, and are also screened for SRDs which are not reportable in D056A.

The purpose of this Desmatics investigation was to validate the processing of base corrective labor hour data, and to examine the use of SRD cards (SRDs not reportable in D056A) in base labor and material processing.

Procedure:

1. Desmatics initially spot checked a few TMSs and found that the corrective manhours in the annual field, over all Work Unit Codes (WUC) for a given TMS, in many cases greatly exceeded the sum of the manhours in the four quarterly fields. A program was then written to check all TMSs in the Base Labor file in the same manner.
2. The processing was examined in order to determine how SRD cards are being used.

Files Used:

Cumulative Base Labor Update - PJMM2A1 (Format PJNWLAB)

Results:

1. The FY83 Base Labor File consisted of 30,997 records, one per WUC, but there were only 680 TMSs represented. Of these, there were 551 TMSs (81%) which had a difference between the sum of the four quarters and the annual labor hours. However, there is some question as to what the four quarterly fields in this file actually represent.
2. A check of the program logic indicates that the C-E system makes no use of either the WUC level of detail or quarterly base labor data.

3. The use of SRD cards in Program M6 was found to serve no purpose. Originally, these cards represented SRDs exempt from D056A reporting, but the Office of VAMOSC has also used them for SRDs not in the TMS-NSN Table. SRDs exempt from reporting will never be found in the interface file unless reporting exemptions are removed. Labor hours are also screened against the SRDs in the TMS-NSN Table in later processing. This double screening is a duplication of effort.

4. Even though some SRDs may be exempt from D056A reporting, they nevertheless may be found in D002A. By screening D002A records for these exemptions, valid material costs may be lost. D002A records are also screened for the SRDs in the TMS-NSN Table. This double screening only adds extra processing to the C-E system.

Recommendations:

1. The quarterly manhour fields of the Base Labor File should not be included in C-E processing, as they serve no purpose.

2. D056A records for C-E end items should be rolled up over WUCs at an early processing stage, since WUC level visibility is not required in the C-E system.

3. The use of SRD screening is unnecessary and should be eliminated from Program M6 in Work Unit M1 and Program M3 in Work Unit M2 to simplify processing and reduce table maintenance.

F. TABLE 1 INVENTORY CONSISTENCY

C-E inventory information is obtained from D039 Format 50 records which are received quarterly. Table 1 records contain the four quarterly inventory figures and the computed average annual inventory. The purpose of this investigation was to determine if these inventory figures are consistent and reasonable.

Procedure:

1. Table 1 quarterly inventory fields were summed, divided by four, and checked against the average annual inventory to determine whether the averages were correctly computed.
2. The quarterly inventories for each TMS were examined to find the difference between the largest and the smallest. The TMSs were then listed in order of decreasing differences as a means of identifying the TMSs with the largest variation.

Files Used:

Reportable TMS File (Table 1) - PJMXJAO (Format DIGSOP PJRPTMS)
Depot Maintenance Cost File (Table 8) - PJMXIAO (Format DIGSOP PJTAB08)

Results:

1. The average of the four quarterly inventories was found to equal the average annual inventory for all TMSs in the Table 1 File.
2. There were fairly sizable differences in the quarter-to-quarter inventories for many of the TMSs in Table 1. While some of these may be valid (e.g., because of phase-ins or phase-outs), many appear to be possible discrepancies in the D039 Format 50 inventory data provided to the C-E system. Figure 1 shows TMSs having differences of 20 or more between the largest quarterly inventory and the smallest, listed in order of decreasing difference.

The GRR023, the TMS at the top of the list, has an anomalous first quarter FY83 inventory, since the other quarters agree quite well with each other. The anomalous first quarter has a very significant effect on the average annual inventory. The average of the last three FY83 quarters was 1060 compared with 5574.75 for all four quarters.

Recommendation:

There appear to be serious discrepancies in the D039 Format 50 inventories, as indicated by several rather large quarter-to-quarter differences. The inventory data for a more recent fiscal year should be checked, and any significant discrepancies should be discussed with the OPR for D039.

<u>TMS</u>	<u>DIFF</u>	<u>Q1</u>	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	<u>Avg-Inv</u>
GRR023	18138	19119	1103	981	1096	5574.75
R02174P	376	653	463	308	684	527.00
R00390	305	2040	2075	2180	1875	2042.50
GRR024	234	3599	3688	3454	3640	3595.25
GRT022	115	1766	1881	1791	1768	1801.50
M028ASR	99	549	549	467	566	532.75
PT0006	85	305	345	349	264	315.75
PRC104	78	616	586	590	664	614.00
CV0425U	75	1335	1380	1378	1305	1349.50
UYK022	73	136	119	102	175	133.00
GRT021	66	398	362	354	420	383.50
TH0022	64	876	920	888	856	885.00
KL7	63	351	382	391	328	363.00
TSC60V2	61	1	1	1	62	16.25
GRC175	56	353	355	299	339	336.50
GRC171	52	1696	1717	1672	1665	1687.50
TT470FGC	50	333	331	347	297	327.00
45BX3263	50	46	12	12	62	33.00
FRC102V	44	55	25	25	69	43.50
SKY515	44	199	195	223	179	199.00
KW26CRX	43	54	97	97	55	75.75
KW26CTX	43	54	97	97	54	75.50
KW26C1TX	42	795	753	762	792	775.50
FRR078V	40	106	116	84	76	95.50
GS0080	39	231	270	259	265	256.25
TT637U	38	77	77	113	75	85.50
GMQ013A	36	684	681	648	682	673.75
FRR097V	35	15	15	15	50	23.75
KW26C1RX	35	795	760	778	795	782.00
R1307A	30	63	63	63	33	55.50
GCC021A	29	25	9	0	29	15.75
TT774G	29	89	81	67	96	83.25
TT775G	28	28	0	0	28	14.00
PRC047	27	241	247	266	239	248.25
UGC129	27	199	194	192	219	201.00
AS3482/G	26	29	21	3	29	20.50
GMQ010B	26	305	317	301	291	303.50
FSA014	25	50	31	31	56	42.00
PRC066B	25	629	606	631	627	623.25
CP1057GR	23	6	29	6	6	11.75
FPS077V	22	362	353	340	357	353.00
FRA037	22	13	4	0	22	9.75
BPN012	22	0	22	22	0	11.00
R00002	22	40	43	55	33	42.75
GRA039	21	290	280	297	276	285.75
GRA083	21	214	198	194	193	199.75
UPA062C	21	266	283	262	262	268.25
FSH009	20	20	20	24	4	17.00
MD0700	20	53	48	33	52	46.50

Figure 1 : TMSs With Large Quarterly Inventory Differences

III. WORK UNIT AN

Work Unit AN processes information for thirteen of the nineteen C-E system cost categories. These include the four personnel cost categories (Operations, Base Maintenance, Administrative, and Supply Support), the three installation support cost categories (Base Operating Support (BOS), Real Property Maintenance (RPM), and Communications (COM)), Utilities, Fuel, General Depot Support, and the three indirect personnel cost categories (Temporary Duty (TDY), Medical, and Permanent Change of Station (PCS)).

This is one of the largest work units of the C-E system, and includes the following programs:

- B3 - Build Personnel Data File
- C4 - Build TMS Data Workfile
- C5 - Build Unit TMS Data File
- F1 - Build PAS-RPM File
- F2 - Build Unit Work File
- E1 - Build O&S Cost Expenditure File
- G1 - Build Cost Output File

In this section Desmatics evaluates the main functions of each of these programs.

The PAS-ORG Table and the TMS-NSN Table are principal drivers of this work unit. They determine to a large degree which costs are selected and subsequently allocated to end items. Because of the importance of the PAS-ORG Table in this work unit, a discussion of the completeness of this table for the three sample TMSs of interest to the Office of VAMOSC is also included in this section.

At the end of this section, Desmatics compares the FY83 O&S Cost Reports

of the three sample TMSs to ones generated by Desmatics. Desmatics' O&S Cost Reports for FY83 contain all the cost information available in this work unit while the C-E system reports do not. This is because the C-E system rejects some cost information in this work unit, as discussed in Section III.E.

A. PAS-ORG TABLE

The accuracy of the tables input to the C-E system greatly impacts the quality of its outputs. With this in mind Desmatics examined the Assets by Organization File for three TMSs in order to determine if all C-E organizations which own these equipments are included in the PAS-ORG Table.

Procedure:

1. The NSNs in the Assets by Organization file were matched to the NSNs in the TMS-NSN Table for three TMSs of interest to the Office of VAMOSC: TPN019V, TPS043E, and TRC097A.
2. The organizations which owned these TMSs were then compared with the entries in the PAS-ORG Table. From this information appropriate additions to the PAS-ORG Table were determined.

Files used:

TMS-NSN Table - PJMA2AO (Format DIGSOP PJTMNST)
Assets by Organization - PJMC1BO (Format DIGSOP PJABORG)
PAS-ORG Table - PJMA3EO (Format DIGSOP PJPASOT)

Results:

1. Listed below is the information found in the Assets by Organization file and the PAS-ORG Table for the TPN019V, TPS043E, and TRC097A:

TPN019V

Total	- 8 TMSs at 3 organizations
Active Duty	- 8 TMSs at 3 organizations
PAS-ORG Table	- 8 TMSs at 3 organizations

TPS043E

Total	- 55 TMSs at 54 organizations
Active Duty	- 32 TMSs at 31 organizations
PAS-ORG Table	- 27 TMSs at 26 organizations

TRC097A

Total	- 339 TMSs at 113 organizations
Active Duty	- 210 TMSs at 52 organizations
PAS-ORG Table	- 179 TMSs at 43 organizations

Active duty organizations were considered to be those in the Assets by Organization file with a Stock Record Account Number (SRAN) which did not begin with a "6." Air National Guard (ANG) and Air Force Reserve (AFRES) organizations have a SRAN beginning with "4" [16]. The discrepancies between active duty organizations and those in the PAS-ORG Table may indicate organizations to be added to the PAS-ORG Table.

2. Desmatics looked at those active duty organizations which were not in the FY83 PAS-ORG Table and determined that most of the missing organizations are not legitimate C-E types, e.g. Electronic Systems Division (ESD), Rome Air Development Center (RADC) and the Sacramento ALC (SM-ALC) were three such organizations. They probably should not be added to the PAS-ORG Table.

A new work unit (IA) was added to the C-E system which allows the PAS-ORG Table to be updated for all TMSs. The TMS-NSN Table is matched to the Assets by Organization file and the PAS-ORG Table. Organizations which are not in the PAS-ORG Table, but which own TMSs in the TMS-NSN Table will be listed in a PAS-ORG Table Additions report. Care must be taken not to include ANG and AFRES organizations, as well as organizations which may own these equipments solely for testing or training purposes (e.g., ESD).

3. The FY83 C-E O&S Cost Reports show Format 50 inventories of 10 for the TPN019V, 54 for the TPS043E and 335 for the TRC097A. These figures differ from the Air Force-wide Format 100 inventories obtained from the Assets by Organization file (8, 55 and 339 respectively). This could, however, be due to the fact that the inventory on the O&S Cost Reports comes from a four quarter average of Format 50 records while the Assets by Organization file contains a fourth quarter snapshot of Format 100 records. As pointed out in a previous section, Desmatics also has some questions regarding the discrepancies found in the Format 50 inventory figures from one quarter to another.

Recommendation:

In Work Unit IA, all active duty organizations which own TMSs in the TMS-NSN Table should be added to the PAS-ORG Table, and then screened for C-E personnel. It is expected that most organizations which own C-E assets and have C-E personnel would be legitimate C-E organizations to be included in the final PAS-ORG Table. However, organizations such as ESD or the Air Logistics Centers probably should not be added to the final table even if they have both C-E equipment and personnel, because they are not typical C-E organizations.

B. PERSONNEL DATA FILE

This section evaluates the C-E system processing done in Program B3 - Personnel Data File. The function of Program B3 is to build the Personnel Data File, the Average Cost File, and the Total PAS Personnel file. The C-E MPC Extract file (PIMBEAB) generated by VAMOH is input to this program, and C-E personnel records are selected and classified. Pay, medical, and PCS costs for these personnel are calculated using standard rates input to the system by the Office of VAMOSC. This information is then written to the Personnel Data File.

In addition to personnel records, VAMOH passes to the C-E system summary records containing geographic locations (GELOCs) and the total number of personnel at those GELOCs. These records are used in the calculation of BCF costs. The summary records for each GELOC with C-E personnel are totaled and

written to the Average Cost File. The Total PAS Personnel File contains this information for each PAS.

Program B3 affects the calculation of costs for the categories of Operations Personnel (OPS), Base Maintenance Personnel (MAINT), Administrative Personnel (ADMIN), and Supply Support Personnel (SSUP). The costs calculated for Medical, PCS, and BOS are also affected by this program.

Procedure:

1. All records for PAs DFOTFS9T, SJODFPTB, and WUOYFY1K were selected from the Consolidated Quarterly Military Personnel File. The record counts (which contain four quarter totals) were divided by four and the C-E personnel selection criteria were duplicated. The resulting outputs were then compared to the C-E Personnel Data File. The C-E MPC Extract (File PIMBEAB, Format DIGSOP PJMPCEX) generated by VAMOH was not used in this process because Desmatics wanted to be able to determine which personnel in these organizations were not selected by either VAMOH or C-E processing.

The computation of pay, Medical and PCS costs done by the C-E system was not duplicated, as Desmatics did not have the appropriate factors. The processing of the Average Cost File and the Total PAS Personnel File was also not duplicated.

2. Personnel records from the VAMOH Consolidated Quarterly Military Personnel file with Functional Account Codes (FACs) of .26xx, .36xx, and .33xx were

totaled by PAS. These numbers, which approximate the totals by PAS in the C-E MPC Extract File (PIMBEAB), were compared with the total number of personnel by PAS output to the Personnel Data File. The C-E MPC Extract was not used for this process because Desmatics did not have the version of this file used in the final FY83 production run of the C-E system.

Files used:

Consolidated Quarterly Military Personnel File - PIMBEACD160. (Format DIGSOP PICQMPF)

Personnel Data File - PJMB3AO (Format DIGSOP PJPDM)

PAS-ORG Table - PJMA3EO (Format DIGSOP PJPASOT)

Results:

1. The selection criteria for personnel overlap for some categories. Because separate routines are used by the C-E system to select Administrative, Operations, Supply Support, and Maintenance Personnel some records are being selected for more than one category. This results in double-counting. The MPC file should be searched only once, instead of once for each category, and a record once selected should not be selected again.

For the three organizations which were examined in detail, the extent of double-counting is shown below:

PAS	<u>Double-Counted</u>		FAC	AFSC	Categories
	<u>Personnel</u>	<u></u>			
DFOTFS9T	none				
SJODFPTB	.75	3820	70230	ADMIN, OPS	
WUOYFY1K	1.00	3810	70230	ADMIN, OPS	
	1.25	3820	70230	ADMIN, OPS	
	1.50	3820	70250	ADMIN, OPS	
TOTAL	4.50	----			

Further examples of double-counting can be seen when the total number of personnel by PAS input to this program is compared to the total number output to the Personnel Data File. Listed below are examples Desmatics found when MPC input data records with FACs of 26xx, 35xx, and 38xx were compared by PAS with the totals output to the Personnel Data File:

PAS	<u>Input</u>	<u>Output</u>
AHOVFFR4	185.00	200
CPOYFFJT	799.75	834
EDOYFFK3	434.50	453
ELOYFFLJ	452.50	478
KFOYFFQJ	499.25	526
UPOYFJSL	528.00	556
YMOYFFJN	762.00	781

The extent of overcounting is at least this bad, because the input totals calculated by Desmatics are most likely larger than those in the C-E MPC Extract file. This is because Desmatics counted all records with FACs of 26xx, 35xx and 38xx, while VAMOH uses the FAC Table, which is a subset of these FACs, to select C-E records.

2. Some of the discrepancy in personnel counts is also due to the rounding procedure used by the C-E system. The MPC file input to this program contains quarters of personnel, while the Personnel Data File contains only whole numbers. The C-E system first rounds the personnel counts on the MPC records and then accumulates these to the categories of Operations, Maintenance, Administrative, or Supply Support Personnel.

This rounding procedure tends to overstate personnel counts since there are two chances of rounding up (if the count ends with .5 or .75), and only one chance of rounding down (if the count ends with .25). A more accurate and efficient method of rounding would be to accumulate personnel first, and then round these counts.

The discrepancies caused only by the rounding procedure for PASs DFOTFS9T, SJODFPTB, and WUOYFY1K for the categories of Administrative, Operations, and Supply Support Personnel are shown below. Base Maintenance Personnel records, which are accumulated to FAC and AFSC, are not included below because of the large number of records for each PAS, but similar results occur for those records.

	DFOTFS9T			SJODFPTB			WUOYFY1K		
	Actual	Rounded	C-E	Actual	Rounded	C-E	Actual	Rounded	C-E
ADMIN	10.00	10	10	14.25	14	16	30.25	30	34
OPS	1.75	2	2	34.75	35	39	100.50	101	101
SSUP	3.00	3	4	3.75	4	4	12.50	13	16
TOTAL	14.75	15	16	52.75	53	59	143.25	144	151

As can be seen, rounding these counts after accumulating produces figures which are much closer to the actual counts than those produced by the current method.

3. The personnel selection criteria currently employed by the C-E system may be too restrictive. Desmatics has previously addressed this problem in Technical Report No. 118-1 [21] and in C-E Data Automation Requirements dated December 1984 [3]. For PASs DFOTFS9T, SJODFPTB, and WU0YFY1K a comparison of the total personnel in the PAS and the total selected by the C-E system is shown. The results are typical of all PASs in the PAS-ORG Table.

<u>PAS</u>	<u>PAS Count</u>	<u>C-E Count</u>	<u>Difference</u>
DFOTFS9T	92.25	49.50	42.75
SJODFPTB	317.00	164.50	152.55
WU0YFY1K	404.75	313.25	91.50

As can be seen, a large number of personnel in these organizations are not costed by the C-E system. An examination of the FAC-AFSC combinations for personnel at these PASs reveals that most of them are ground radar operators, administrators, generator and vehicle maintenance mechanics, and other legitimate C-E personnel [2,6,11]. The revised personnel selection criteria outlined in Desmatics' C-E Data Automation Requirements [3] would include these types of personnel.

It should be noted that undercounting of personnel is a greater problem for organizations which are not in the Air Force Communications Command (AFCC). Some of these non-AFCC organizations do not have C-E as a primary

mission but many do (such as the TAC and USAFE organizations with PASS DFOTFS9T and SJODFPTB). Again, the Desmatics' proposed personnel selection criteria should cost the personnel in these organizations appropriately.

4. There are also some PASs in the PAS-ORG Table which did not have any MPC records with FACs of 26xx, 35xx and 38xx. These are listed below:

<u>PAS</u>	<u>ORGANIZATION</u>
AMOQFRCC	17 Weather Squadron
CHOTFBH8	84 Fighter Intercept Training Squadron
CKOJFB8L	3345 Air Base Group
DTOYFJHY	1974 Communications Grp. Detachment 3
HFOTFBNW	21 Air Def Sage
LEOTFFXT	667 Aircraft Con/Wng Squadron
LEOYF2RH	1913 Communications Grp. A4
NJOTFV61	57 Aircraft Generation Squadron
TXOJFC8K	3625 Technical Training Squadron

Some of the above organizations are not C-E organizations, so they should not be included in the PAS-ORG Table. These would be marked for deletion when Work Unit IA is fully implemented. PASs DTOYFJHY and HFOTFBNW are not listed in the PAS Directory [12] and could possibly be typographical errors in the C-E PAS-ORG Table. Detachment 3 of the 1974 Communications Group has a PAS of GMOYFJHY listed in the PAS Directory.

5. Some PASs have personnel at multiple geographic locations (GELOCs). The C-E system processes such situations in an inefficient manner. The computation of the average BOS cost may also be adversely affected in these instances.

PAS WUOYFY1K, the 1st Combat Communications Group, has personnel in 13 locations. Most personnel are at Lindsey AS, Germany but others are located at Aviano ABS, Bentwaters RAF, Comisa ASN, Hickam AFB, Lakenheath RAF, Mildenhall RAF, Ramstein ABS, Shape ADM, Spangdahlem ABS, Stuttgart-Vaihing CTY, Tinker AFB, and Wright-Patterson AFB. PAS DFOTFS9T has personnel at five GELOCs and PAS SJODFPTB has personnel at three GELOCs.

Current processing is inefficient because MPC records are sorted first by GELOC and then by PAS. Costs are accumulated to the categories of Operations, Maintenance, Administrative, and Supply Support Personnel once for every GELOC-PAS combination, when only one accumulation per PAS for each category is necessary. For example, PAS WUOYFY1K had personnel records processed 13 times.

The computation of the average BOS cost may be affected as well. Summary records contain a total personnel count by GELOC. Provision is made in Program B3 for multiple PASs at a GELOC, but it is not clear how PASs with multiple GELOCs are processed. (Desmatics does not have the necessary files to duplicate this process.) If all summary records are included regardless of the presence of C-E personnel at that GELOC, the processing of the Average Cost File should not be affected by multiple GELOCs per PAS.

6. The Total PAS Personnel File, which is also built from the personnel summary records, is unnecessary. Since a base operations factor is no

longer used in the computation of BOS costs, this file no longer serves any purpose.

Recommendations:

1. Instead of using the FAC table in VAMOH preprocessing to screen MPC data, personnel records should be selected by PAS using the PASs in the PAS-ORG Table. This would allow for broader personnel selection criteria in the C-E system (as previously outlined by Desmatics in C-E Data Automation Requirements [3]), and would result in more efficient processing.

By screening for PASs in the PAS-ORG Table, unnecessary processing currently done for PASs which are not in the PAS-ORG Table would also be eliminated. These PASs are later rejected by the system. Under the current method, the FY83 Personnel Data File contained 1039 organizations while the PAS-ORG Table contained only 366 organizations. Using FY83 as an example, the C-E system is processing approximately 3 times the organizations it needs to in this program.

2. The C-E MPC Extract should be sorted by PAS before building the Personnel Data File. This would eliminate the problem of accumulating personnel costs multiple times for a given PAS when that PAS has personnel at several GELOCs.
3. The revised personnel selection criteria proposed by Desmatics should be implemented in order to provide more complete costing of C-E personnel. A

personnel record, once selected, should not be selected again, and the personnel counts in the C-E MPC Extract should be rounded only after the records have been accumulated to the appropriate categories.

4. An average BOS cost per mission person should be computed as outlined in Desmatics Technical Report No. 118-5 [18]. This worldwide cost per mission person would allow the VAMOH preprocessor to pass a single summary record containing total mission personnel, rather than the summary records for each GELOC currently used.

In the meantime, summary records for all GELOCs should be included in the Average Cost File, regardless of the presence of C-E personnel. It is important to include worldwide personnel counts since they are later matched to worldwide costs.

5. Since the base operations factor is no longer used in the computation of BOS costs, the Total PAS Personnel File generated by this program is unnecessary and should be eliminated.
6. Maintenance personnel costs in the Personnel Data File are currently accumulated by FAC-AFSC combinations. The FAC portion of these records is not used beyond this point in the processing, and only adds unnecessary volume to the system. Desmatics recommends that these costs be accumulated by AFSC only.

This change in processing along with Recommendation 2 (sort MPC by PAS)

would drastically reduce the volume of records in the Personnel Data File. For example, the total number of records in the FY83 Personnel Data File for the organizations with PASs DFOTFS9T, SJODFPTB, and WUOYFY1K is 251. Sorting records first by PAS and accumulating maintenance costs only to AFSC reduces the number of records for these organizations to 33 with no loss of information.

C. UNIT TMS DATA FILE

In this section Desmatics evaluates the processing done in Programs C4 - TMS Data Workfile and C5 - Unit TMS Data File. In Program C4 the PAS-ORG Table and the TMS-NSN Table are matched to the Assets by Organization file in order to build a list of all TMSs in the TMS-NSN Table owned by the organizations in the PAS-ORG Table. The resulting TMSs are the ones which are costed by the system in this work unit.

Program C5 computes allocation factors for these TMSs. These are the Unit TMS Allocation Factor, the Worldwide TMS Allocation Factor, the AFSC Allocation Factor, and the Worldwide AFSC Allocation Factor. The TMS allocation factors are based on the total value of a given TMS relative to all TMSs at the unit or worldwide. The AFSC allocation factors are based upon equipment value within an AFSC at the unit or worldwide.

Of these factors, the Unit TMS Allocation Factor is most important as it is used in the allocation of eight cost categories in the C-E system (Administrative and Supply Support Personnel, PCS and Medical for these personnel, BOS, RPM, COM, and TDY). The Worldwide Allocation Factor is used

to allocate General Depot Support costs to end items. The AFSC allocation factors are not used in any cost allocations.

Program C5 also computes Utilities costs for each TMS based on annual kilowatt hours provided in the TMS-NSN Table and utility costs per megawatt hour for the GELOCs of the PASs in the PAS-ORG Table. Utility costs per GELOC are obtained through the F006 system and are input to the Base Utility Rate File by the Office of VAMOSC. Base utility rates are identified by a Cost Account Code (CAC) of 21020 in this file.

Procedure:

1. All of the assets for PASs DFOTFS9T, SJODFPTB, and WU0YFY1K were selected from the Assets by Organization file. This file was then matched by NIIN against the TMS-NSN Table to see which of the organizations' assets are costed by the C-E system.
2. The records for these organizations were also selected from the Unit TMS Data File. The TMSs in the Assets by Organization file and those in the Unit TMS Data File for these organizations were compared.
3. Desmatics attempted to duplicate the computation of the Unit TMS Allocation Factors for these organizations in order to determine if the TMSs in the table are the only items used in the denominator of this factor, or if all TMSs at the organization are used. Since the TMS-NSN Table is not an exhaustive list of TMSs, all items at an organization should be included in order not to overallocate costs to the TMSs which

are in the table.

The quantity on hand and acquisition cost from the Assets by Organization file were used to compute the Unit TMS Allocation Factor for each TMS. These factors were then compared with those in the Unit TMS Data File. The computations of the Worldwide Allocation Factor, Unit AFSC Allocation Factor, and Worldwide AFSC Allocation Factor in Program C5 were not duplicated by Desmatics.

4. Desmatics used information in the Base Utility Rate file, PAS-ORG Table and the TMS-NSN Table in order to duplicate the calculation of Utilities costs. The Utilities costs calculated by Desmatics were then compared with those in the Unit TMS Data File.
5. The information contained in the Unit TMS Factor Table was also compared with the data in the Unit TMS Data File. The Unit TMS Factor Table contains factors used to allocate Fuel and Operator costs in later system processing.
6. The PAS-ORG Table and the TMS-NSN Table were matched to the Unit TMS Data File to see which PASs had no TMSs and which TMSs were not included in the Unit TMS Data File.

Files used:

Assets by Organization - PJMC1B0 (Format DIGSOP PJABORG)
PAS-ORG Table - PJMA3EO (Format DIGSOP PJPASOT)
TMS-NSN Table - PJMA2AO (Format DIGSOP PJTMNST)
Unit TMS Data File - PJMC5AO (Format DIGSOP PJTMSDN)
Base Utility Rate - PJMC2B0 (Format DIGSOP PJSRBUR)
Unit TMS Factor Table - PJMA2B0 (Format DIGSOP PJTMSFT)

Results:

1. Each of the organizations examined had many items of equipment (especially test equipment) which were not included in the TMS-NSN Table. Program C4 seems to be working as intended, since the TMSs from the table in the Assets by Organization file matched those in the Unit TMS Data File exactly.
2. The information in the Unit TMS Factor Table for the three organizations matched that in the Unit TMS Data File.
3. In some instances Utilities costs were correctly calculated; however, there were 68 PASs for which this was not the case. These organizations had no Utilities costs, yet there were entries in the Base Utility Rate file for the GELOCs of these organizations, and the TMSs at these organizations had annual kilowatt hours (KWH) in the TMS-NSN Table.

For example, each TMS in PAS SJODFPTB showed no Utilities costs in the Unit TMS Data File. The GELOC for this organization is VGWU which had a FY83 utility cost of \$63.17 per megawatt hour (MWH) in the Base Utility

Rate file. Using the formula the C-E system uses to compute Utilities costs, TMSs at PAS SJODFPTB with annual nonzero kilowatt hours (KWH) in the TMS-NSN Table should have had the following Utilities costs:

Utilities Cost = \$ per MWH x .001 x KWH x Quantity of TMS

<u>TMS</u>	<u>KWH</u>	<u>Quantity</u>	<u>Utilities (\$)</u>
GSQ120V1	2,628	2	332
S530AG	9	3	1
TGC028	99,999	2	12,633
TPS043E	600,060	2	75,811
TRC087	438	4	110
TRC097A	55,188	16	55,779
TSC062	2,628,000	2	332,021
TSC60V1	78,840	4	19,921
TSQ091V	131,400	1	8,300
TTC030	87,600	2	11,067
TYC010	131,400	1	8,300
UPA062C	2,628	1	166
<hr/>			<hr/>
Total Understatement of Costs			\$524,441

There were 68 organizations with no Utilities costs whose GELOCs had a cost per MWH in Cost Account Code 21020 in the Base Utility Rate file, and whose TMSs had KWH figures in the TMS-NSN Table. Desmatics has been unable to determine why Utilities costs are sometimes computed incorrectly in this program.

There were an additional 61 organizations in the Unit TMS Data File whose GELOCs were missing from the Base Utility Rate file. These organizations had no Utilities costs either, even though they owned TMSs which had nonzero KWH in the table.

4. There was one GELOC in the Base Utility Rate file which had two rates for Cost Account Code (CAC) 21020. There were two records for GELOC ZSYQ; one had a cost per MWH of \$96.46 and the other had a cost per MWH of \$66.25. This causes an error statement to be generated.
5. There are cases where a TMS has more than one NSN or SRD. In the FY83 table some TMSs had KWH for their first listed NSN and zero KWH for their other NSNs. Since Program C5 does not recognize multiple KWH figures for a TMS, only one line of the TMS-NSN Table is used. Apparently, a line of the table with zero KWH is being used, since Utilities costs for all of these TMSs are zero.
6. Desmatics has found one PAS which is listed twice in the PAS-ORG Table in FY83. The entries are:

<u>ORG</u>	<u>PAS</u>	<u>GELOC</u>
0001COE60002	LYOSFH49	ZZZZ
R0001COE60002	LYOSFH49	KVXD

The correct entry probably should be:

0001COE60002	LYOSFH49	KVXD
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7. For a number of organizations the Unit TMS Allocation Factor is not being calculated correctly. Two of the three organizations Desmatics looked at (DFOTFS9T and SJODFPTB) had the same factor for every piece of equipment at that organization. The third organization, WUUYFY1K, had correctly computed factors. However, these were based only on the TMSs in the TMS-NSN Table.

Desmatics then looked at the entire FY83 Unit TMS Data File and found that 120 organizations (34% of all organizations) had the same Unit TMS Allocation Factor for every item of equipment. (Note: these 120 organizations do not include any organizations which own only one TMS.) The numbers in the Unit TMS Allocation Factor field for these PASs bear no resemblance to the allocation factors which should be computed for these organizations.

It seems that every organization with incorrect Unit TMS Allocation Factors also had no Utilities costs. If a PAS has no Utilities costs, Program C5 does not calculate a Unit TMS Allocation Factor, but instead places the last calculated factor in this field for each TMS until the program comes to another PAS which has Utilities costs.

This is a significant problem since there are eight cost categories in the C-E system which use the Unit TMS Allocation Factor to allocate costs to end items. To give an example of the magnitude of the problem, in Figure 2 are the factors in the Unit TMS Data File and the actual factors for the TMSs at PASs DFOTFS9T and SJ0DFPTB. As can be seen, overallocation or underallocation may occur for the individual TMSs or for the organization as a whole.

<u>TMS</u>	<u>QOH</u>	<u>ACQCOST</u>	<u>C-E Factor</u>	<u>Correct Factor</u>
DFOTFS9T				
GRA039	1	481	.331907	.000211
PRC104	1	14,835	.331907	.006511
MX8576T	1	17,099	.331907	.007505
RD0217	4	805	.331907	.001413
S530AG	1	129,266	.331907	.056734
TA312PT	25	230	.331907	.002524
TPS043E	1	1,415,678	.331907	.621327
TRC097A	2	228,338	.331907	.200430
TSC053	1	85,000	.331907	.037305
TSQ061	2	63,166	.331907	.055446
UGC129	1	15,703	.331907	.006892
VRC046	3	2,812	.331907	.003702
TOTAL		3.982884	-----	1.000000
SJODFPTB				
GSQ120V1	2	565,429	.039901	.054801
PRC077	2	3,124	.039901	.000303
PRC104	9	14,835	.039901	.006470
SS30AG	3	129,266	.039901	.018793
TGC028	2	73,763	.039901	.007149
TPS043E	2	1,415,678	.039901	.137207
TRC087	4	150,000	.039901	.029076
TRC097A	16	228,338	.039901	.177043
TSC062	2	553,625	.039901	.053657
TSC60V1	4	673,413	.039901	.130534
TSC60V4	3	809,804	.039901	.117729
TSQ091V	1	2,447,280	.039901	.118595
TTC030	2	481,500	.039901	.046667
TYC010	1	2,000,000	.039901	.096920
UPA062C	1	25,000	.039901	.001210
UPX023	1	37,672	.039901	.001826
VRC046	4	2,812	.039901	.000545
WTVD2228	9	3,383	.039901	.001475
TOTAL		.718162	-----	1.000000

Figure 2. Unit TMS Allocation Factors

8. Desmatics found eight PASs which had no TMSs in the Unit TMS Data file. These PASs, which are listed below, would have been eliminated from the PAS-ORG Table if Work Unit IA had been implemented for FY83.

CK0JFB8L (also had no C-E personnel)
GWOYFQS2
KVOYF3LZ
LEOYF2RH (also had no C-E personnel)
MHOYFFLY
OPORFZSO
SJODFGJI
SJODFZ09

9. Over 30% of the TMSs in the FY83 TMS-NSN Table (261 of 842) were not in the Unit TMS Data File. This is because the organizations in the PAS-ORG Table did not own these TMSs or the TMSs are not reportable in the D039 system. For whatever reason, these TMSs will have no costs for the following categories:

- 1) Operations Personnel
- 2) Administration Personnel
- 3) Supply Support Personnel
- 4) Fuel
- 5) Utilities
- 6) Base Operating Support
- 7) Real Property Maintenance
- 8) Communications
- 9) TDY
- 10) PCS (for above personnel)
- 11) Medical (for above personnel)
- 12) General Depot Support

Where inventory figures are available, the PASs which own these TMSs should be in the PAS-ORG Table. Items with no inventory or items which are not reportable in D039 should not be included in the TMS-NSN Table. Since so many cost categories depend upon information in the D039 system, good cost reports for items not reported in this system are not possible.

In addition to the cost categories above, Depot Maintenance, Replacement Investment, and Transportation and Packaging also depend on D039 information for the calculation of costs.

Recommendations:

1. High priority should be given to fixing Program C5 so that the Unit TMS Allocation Factors are correctly computed. If this is not done, costs in the categories of Administrative Personnel, Supply Support Personnel, BOS, RPM, COM, TDY, Medical and PCS will continue to be meaningless. Although the Unit TMS Allocation Factor is not the most appropriate means of allocating costs (especially since TMSs in the table are the only ones used to calculate this factor), it is important that the factor be correct until alternative methodologies are in place.
2. The Office of VAMOSC should also determine why Utilities costs are not being calculated for some organizations, and remedy this problem. Utilities costs can also be improved by including a KWH figure in the TMS-NSN Table for every line in the table. When a TMS has several NSNs or SRDs and a KWH figure only for the first line, the Utilities costs for that TMS are zero.

The Base Utility Rate file should be checked to ensure that there is only one record per GELOC and CAC, and every GELOC in the PAS-ORG Table should be included in that file. Each record for CAC 21020 in the Base Utility Rate file has two dollar fields, total cost and cost per megawatt hour.

The total cost field for this CAC is unnecessary.

3. PASs which do not own any TMSs in the TMS-NSN Table should be deleted from the PAS-ORG Table. PASs which own TMSs in the table should be added. The PAS-ORG Table should be checked for duplicate entries before processing.
4. TMSs which have no inventory and those which are not reportable in the D039 system should be dropped from the TMS-NSN Table. Meaningful cost reports for these TMSs are not possible.
5. The computation of the AFSC Allocation Factor and the Worldwide AFSC Allocation Factor should be eliminated from Program C5. These factors are unnecessary since they are not used in any system processing.

D. PAS-RPM FILE

In this section Desmatics evaluates Program F1 - PAS-RPM File. The function of Program F1 is to allocate Real Property Maintenance costs from the base level to the organization level. RPM costs per GELOC are obtained from the F006 system, and are input to the Base Utility Rate file by the Office of VAMOSC. RPM costs are in the Base Utility Rate file with Cost Account Codes (CACs) 51015 and 51070. These costs per GELOC are multiplied by the RPM Factor calculated in Work Unit YF for each PAS at that base. The RPM Factors are based on the value of equipment at the PAS in relation to the value of equipment at all PASs at the entire base, where base is defined by SRAN.

Procedure:

1. The PAS-ORG Table with RPM Factors was matched by GELOC against the Base Utility Rate file for CACs 51015 or 51070. For matching GELOCs, the costs for the two accounts were added together and then multiplied by the RPM Factor for that PAS.
- 2) The RPM costs computed by Desmatics were matched against the RPM costs in the Unit Work File by PAS.

Files Used:

PAS-ORG Table - PJMA3EO (Format DIGSOP PJPASOT)
Base Utility Rate - PJMC2B0 (Format PJSRBUR)
Unit Work File - PJMF2AO (Format PJUWF)

Results:

1. There were 60 PASs whose GELOCs had no RPM CACs in the FY83 Base Utility Rate file. It appears that an average cost was input for these CACs in many of the records that do appear in this file. This average cost should be input for each GELOC which occurs in the PAS-ORG Table, because all costs for a PAS are rejected later in system processing if it has no RPM costs.

2. Three GELOCs in the Base Utility Rate file had duplicate records for the same RPM CAC. The duplicate records for GELOCs JCGU, JREZ and ZSYQ generate an error file in this program.
3. Most of the RPM costs in the Unit Work File match those which Desmatics computed. However, RPM costs are incorrect in the Unit Work File when there are multiple PASs at a single GELOC. One PAS has the correct RPM cost, but the remaining PASs at that GELOC have the same RPM cost as the first PAS even though the RPM Factors are different.

For example, there are three organizations in the PAS-ORG Table which are located at GELOC MBPB, which is Kelly AFB, Texas. These organizations are the 6948 Electronic Security Squadron (KHOUFFGF), the 6993 Electronic Security Squadron (KHOUFN3B), and the 1923 Communications Group (KHOYFFK6). Listed below are the costs for these PASs in the Unit Work File and as they should appear:

PAS	RPM Factor	C-E Cost	Correct Cost
KHOUFFGF	.193849	\$26,273	\$78,711
KHOUFN3B	.596999	\$26,273	\$242,407
KHOYFFK6	.064707	\$26,273	\$26,273

4. Another problem with RPM costs can be seen in the example above by looking at the RPM Factors, which are based on C-E equipment only. It hardly seems likely that one Electronic Security Squadron would consume almost 60% of Kelly AFB's real property maintenance services, considering the aircraft mission and the Air Logistics Center which are also located at the base.

5. Although the system tutorials indicate that a reject is generated when both RPM CACs are not present, cost data is not actually rejected when this occurs. Costs resulting from a single CAC are found in the FY83 Unit Work File.

Recommendations:

1. The Office of VAMOSC should ensure that RPM costs are included in the Base Utility Rate file for each GELOC listed in the PAS-ORG Table.
2. Duplicate CAC records for a single GELOC should be eliminated from the Base Utility Rate file.
3. Since RPM costs are not always correctly calculated, Program F1 could be modified so that PASs at the same GELOC each receive the correct RPM cost. However, the Office of VAMOSC should consider changing the current method of calculating RPM costs to the one recommended by Desmatics in Technical Report No. 118-5 [18]. In addition to incorrectly allocating costs when there is more than one PAS per GELOC, the current method has three other significant problems which warrant this change.

First, as mentioned earlier in this section, costs are overallocated, since only C-E equipment is taken into account when developing the RPM Factors. Secondly, the current methodology assumes that each PAS will be located at only one GELOC. As pointed out in a previous section, this

assumption is untrue. Third, only a small portion of RPM costs are included in the two cost account codes currently used from the F006 system. As suggested by Desmatics, calculating a worldwide cost per mission person based upon Program Element Code (PEC) xxx94 RPM costs from the H069R system would eliminate these problems.

E. UNIT WORK FILE

In this section the C-E processing of the Unit Work File in Program F2 is examined. The purpose of Program F2 is to bring together all the information accumulated in Work Unit AN about the PASs in the PAS-ORG Table and the TMSs which they own. Six files are input to this program. These are 1) Personnel Data File, 2) PAS-RPM File, 3) Unit Factor Table, 4) Total PAS Personnel File, 5) Unit TMS Data File, and 6) FAC Table. The Unit Work File and the Unmatched PAS Reject Notice are output from this program.

All input files are sorted by PAS. The program first checks for a match on PAS in the Personnel Data File, Unit Factor Table, Unit TMS Data File, and the PAS-RPM File. If a PAS is absent from any of these files it is written to the Unmatched PAS Reject Notice. Cost information about the PAS is rejected to ensure that only TMSs with complete costing appear on the C-E cost reports.

If the PAS is present in all four files, the total number of PAS personnel in the Personnel Data File is compared to the total number of personnel at that organization's base in the Total PAS Personnel File. If the total number of personnel at the base is less than the number of personnel in the PAS, the PAS is written to the Unmatched PAS Reject Notice. Otherwise,

all information about the PAS is written to the Unit Work File. The FAC Table is used to assign Personnel Data File records for the PAS to the categories of Operations, Administrative or Supply Support Personnel.

Procedure:

1. The major processing of the C-E system in Program F2 was duplicated by Desmatics. Records from the Unit TMS Data File, Personnel Data File, Unit Factor Table, and the PAS-RPM File (created by Desmatics) were matched on PAS. On a match of all 4 files the information about that PAS was written to the Unit Work File. If there was no match a reject record for that PAS was written.

Desmatics did not duplicate the Total PAS Personnel check in its processing, since it no longer serves any purpose in the C-E system. This check was originally designed so that the Base Operations Factor for any given PAS would not be greater than one. Since an average cost is used for BOS costs in place of the Base Operations Factor, this check is not necessary. In its results, however, Desmatics did take into account PASs which were rejected in FY83 C-E system processing because the Total PAS Personnel count was less than the number of personnel in the Personnel Data File.

Desmatics did not use the FAC Table in its processing. Since personnel are already accumulated to the categories of Operations, Administrative and Supply Support Personnel in Program B3, a large FAC Table is not

necessary in the processing of Program F2.

2. All instances of TMSs TPN019V, TPS043E, and TRC097A were listed in order to determine how many are costed past this point in the C-E system and the reasons why some may have been rejected.
3. The Unit Work File records for PASs DFOTFS9T, SJ0DFPTB, WUOYFY1K were also examined.

Files Used:

Personnel Data File - PJMB3AO (Format DIGSOP PJPDM)
Unit TMS Data File - PJMC5AO (Format DIGSOP PJTMSDN)
Unit Factor Table - PJMA2BO (Format DIGSOP PJUFTB)
PAS-RPM File (Desmatics generated containing PAS and RPM
cost - See Section III.D)
PAS-ORG Table - PJMA3EO (Format DIGSOP PJPASOT)
Unmatched PAS Reject Notice (PCN Q-D160A-F2A-AN-MF2)
FAC Table - PJMA3GO (Format DIGSOP PJFACTB)

Results:

1. Many PASs and their cost information were rejected needlessly from Program F2. In all, 828 PASs were rejected. Of these, 122 were PASs in the PAS-ORG Table. If the Unit Factor Table (developed by the Office of VAMOSC) and the PAS-RPM File contained records for each PAS in the PAS-ORG Table, as they should, only 13 PASs in the PAS-ORG Table would have been rejected in FY83 from this program. These 13 PASs would have been rejected either because they had no C-E personnel or no TMSs in the TMS-NSN Table. (If Work Unit IA had been in place for FY83, these 13 PASs

would not have been in the PAS-ORG Table to begin with.)

2. An additional 22 PASs from the PAS-ORG Table were rejected even though they were present in the Personnel Data File, Unit TMS Data File, PAS-RPM File, and Unit Factor Table. These PASs were rejected because the number of personnel in the Total PAS Personnel File (which represents a total count of personnel for that GELOC) was less than the number of personnel at that PAS in the Personnel Data File.

This can legitimately occur because a PAS may have personnel at more than one GELOC. Such a PAS will have multiple records in the Total PAS Personnel File, one for each GELOC. If the number of personnel in the Personnel Data File is matched against a Total PAS Personnel record of a remote site GELOC having few personnel, it is conceivable that the Personnel Data File count could be larger than the Total PAS Personnel count. In such cases, legitimate PASs and costs are being rejected from the system.

3. The three organizations Desmatics had looked at in detail were rejected from Program F2 for the following reasons:

DFOTFS9T - not in the PAS-RPM File.
SJODFPTB - not in the Unit Factor Table
WUOYFY1K - Total PAS Personnel < Personnel Data File

Because these PASs were rejected, the following information accumulated to this point is not accounted for in the FY83 C-E system products:

	<u>DFOTFS9T</u>	<u>SJODFS9T</u>	<u>WUOYFY1K</u>
TMSs (#)	43	68	272
Personnel (#)	53	173	328
Operations	\$34,455	\$521,177	\$1,607,356
Administrative	\$201,149	\$320,983	\$674,311
Supply Support	\$43,975	\$60,969	\$219,621
Utilities	N/A	N/A	\$317,887
RPM	N/A	\$192,994	\$14,221
Medical	\$10,114	\$35,490	\$94,453
PCS	\$24,963	\$40,946	\$300,647

4. The current format of the Unmatched PAS Reject Notice in this program is difficult to interpret and much larger than necessary. The Personnel Data File, Total PAS Personnel File and the Unit TMS Data File each may contain more than one record per PAS. Currently, each occurrence of the PAS in these files is printed when a reject PAS is generated. Since each instance of the PAS in different files is generally printed on a separate line, it takes pages of output to determine why a particular PAS was rejected.

If this report contained only one line per PAS with only the first instance of a PAS in a particular file listed, the FY83 reject notice, which is almost 9000 records long, would contain only 850 records. A sample of how this report currently looks, and how it should look, is included as an appendix.

The Unmatched PAS Reject Notice should also contain fewer PASs than it currently does. As mentioned, only 144 of the 850 rejected PASs are in the FY83 PAS-ORG Table. This occurs because personnel processing is not screened for PASs in the PAS-ORG Table before this point. As a result,

much extra volume is added to the system. If the personnel files were first screened for PAS in Program B3 (as was recommended earlier), the reject notice for this program could contain, at most, the number of PASS in the PAS-ORG Table. This would provide more concise information for the Office of VAMOSC, which could immediately tell which PASS in the PAS-ORG Table had incomplete costing.

5. The C-E system currently uses the FAC Table in this program to identify Personnel Data File records as Operations, Administrative, or Supply Support personnel. This is unnecessary. These personnel have already been accumulated to these categories in Program B3 - Personnel Data File. In that program all Administrative Personnel are given FAC 2600, Operations Personnel are given FAC 3800 and Supply Support Personnel are given FAC 262S. Matching these records against a large FAC Table adds unnecessary processing to the system.

The system tutorials for this program also indicate that civilian maintenance personnel will be identified with the FAC Table. There will never be any civilian maintenance personnel costs in the Unit Work File, however, because the Personnel Data File input to Program F2 makes no distinction between military and civilian personnel. All maintenance records will be bypassed by this program since they are accumulated by FAC and AFSC. Only records which are blank in the AFSC field are written to the Unit Work File. Only Operations, Administrative, and Supply Support Personnel records contain a blank AFSC field.

6. Many of the PASs which own the TPN019V, TPS043E, and the TRC097A were rejected at this point in system processing, as can be seen below:

TPN019V

Unit TMS Data File - 8 TMSs at 3 organizations
Unit Work File - 6 TMSs at 2 organizations

TPS043E

Unit TMS Data File - 27 TMSs at 26 organizations
Unit Work File - 2 TMSs at 2 organizations

TRC097A

Unit TMS Data File - 179 TMSs at 43 organizations
Unit Work File - 21 TMSs at 4 organizations

It should be noted that if all PASs which owned these TMSs were in both the Unit Factor Table and the PAS-RPM File, no cost information would have been lost. Section III.H gives the FY83 cost reports for these TMSs that would have resulted if all TMSs in the Unit TMS Data File were also in the Unit Work File.

Recommendations:

1. The Office of VAMOSC should ensure that each entry in the PAS-ORG Table has corresponding entries in the Unit Factor Table and the PAS-RPM File. This will avoid a large number of unnecessary PAS rejects currently generated by the C-E system.
2. The Total PAS Personnel File should be eliminated as an input to this program. This file no longer serves any purpose. Currently, legitimate PASs are sometimes being rejected because multiple GELOCs for a PAS cause

multiple Total PAS Personnel records in this file.

3. The FAC Table is unnecessary to this program and only generates extra processing. It should be eliminated as an input since personnel costs are already accumulated by FAC for Administrative, Operations and Supply Support Personnel. The Civilian Maintenance Personnel field should be eliminated from the Unit Work File since Personnel Data File records will never match the FAC Table for this category.
4. The Reject Notice from this program should be redesigned with only one line per PAS as indicated in the appendix.

F. O&S COST EXPENDITURE FILE

In this section Desmatics evaluates Program E1 - O&S Cost Expenditure File. Inputs to Program E1 are the OAC/OBAN Table, the EEIC (Element of Expense/Investment Code) Table, and the C-E ASO (Accounting System for Operations) Extract. The OAC/OBANS (Operating Account Code/Operating Budget Account Numbers) in the table represent the reporting and supporting OAC/OBANS of the PASs in the PAS-ORG Table. The reporting OAC/OBAN represents the funding authority received directly by the organization. The supporting OAC/OBAN represents the funding authority of the host organization at the base. These OAC/OBANS are matched to the OAC/OBANS in the C-E ASO Extract for selected records.

Costs are selected from the ASO data for the categories of BOS, COM, TDY, Fuel and General Depot Support. Costs for BOS and COM are chosen by Program Element Code (PEC) and matched to the supporting OAC/OBANS in the OAC/OBAN Table. These costs are given Cost Analysis Improvement Group (CAIG) account numbers of 305.10 and 305.30 respectively.

TDY and Fuel costs are chosen using the EEIC Table and the reporting OAC/OBANS in the OAC/OBAN Table. These costs receive account numbers of 306.10 and 302.10. General Depot Support Costs for C-E equipment are generated by VAMOH. They include the C-E portion of PECs 71111, 71112, and 71113 for the Sacramento Air Logistics Center. General Depot Support costs are given cost element code 307.11 by the C-E system.

BOS, COM, TDY, and Fuel cost records for OAC/OBANS in the table are written to the O&S Cost Expenditure File. The General Depot Support cost records are also written to this file. All BOS costs regardless of OAC/OBAN

are totaled and written to the Average Cost File.

Procedure:

1. Using the VAMOH ASO Master files for USAFE and AFCC, Desmatics duplicated the process of building the C-E O&S Cost Expenditure File for selected OAC/OBANs. These OAC/OBANs, from the FY83 C-E OAC/OBAN table, were AFCC reporting OBANs with USAFE supporting OBANs, and USAFE reporting OBANs with USAFE supporting OBANs. The costs computed by Desmatics for the CAIG cost elements of 305.10 (BOS), 305.30 (COM), 302.10 (Fuel) and 306.10 (TDY) were then compared with those generated by the C-E system.

The analysis was not conducted using all OAC/OBANs in the table since Desmatics did not have the version of the FY83 ASO Extract File (PIMEEAA) used in the final FY83 C-E run. Instead, Desmatics used the ASO Master Files used by VAMOH to generate the C-E ASO Extract.

The processing of the Average Cost File was not duplicated. General Depot Support costs are preselected in VAMOH, so nothing was done with these cost records either.

2. Desmatics compared the OAC/OBANs in the Unit Factor Table with those in the OAC/OBAN Table. The reporting OAC/OBANs in the OAC/OBAN Table should be identical to the OAC/OBANs in the Unit Factor Table.

Files Used:

ASO Master Extract - PIMVMDTD160. (Format DIGSOP PIC25V2)
OAC/OBAN Table - PJMA2D0 (Format DIGSOP PJOACTB)
EEIC Table - PJMA3F0 (Format DIGSOP PJEETB)
O&S Cost Expenditure File - PJME1A0 (Format DIGSOP PJOSCEF)
Unit Factor Table - PJMA2B0 (Format DIGSOP PJUFTB)

Results:

1. The expenditure file generated by Desmatics matched the one produced by the C-E system.
2. BOS costs are computed using dollars in the Average Cost File; therefore it is not necessary to accumulate costs by OAC/OBAN to Cost Element Code 305.10 in the O&S Cost Expenditure File as well.
3. Many OAC/OBANS had incomplete cost information for some cost elements. In particular, many had no communications costs since only supporting OAC/OBANS are used to select these costs. Most communications costs are paid by AFCC, but AFCC hosts no bases and will not be included in the C-E list of supporting OAC/OBANS. Therefore, these costs are not selected by the existing C-E system logic. Following is a list of the AFCC reporting OBANS with USAFE supporting OBANS, and the dollar amount of COM costs for each which should be included in the C-E system.

<u>Supporting</u>	<u>Reporting</u>	<u>Supporting \$</u>	<u>Reporting \$</u>
8016	49GB	1,281,657	367,068
8018	49GD	706,196	82,995
8016	49GE	1,281,657	91,095
8007	49GH	465,184	966,415
8061	49GJ	671,370	2,194,193
8070	49GK	0	74,675
8028	49GL	2,295,197	2,426
8066	49GM	326,034	1,371,634
8029	49GP	594,052	1,009,183
8040	49GQ	1,113,809	713,214
8015	49GR	1,308,330	686,704
8051	49GU	0	216,031
8030	49GW	1,467,141	200,200
8031	49GX	504,531	755,343
8050	49GY	466,726	1,093,479
8028	49GZ	2,295,197	500,306
8039	49HB	654,959	1,064,865
8001	49HC	690,766	199,807
8022	49HE	93,217	1,282,594
8024	49HF	599,238	99,537
8044	49HG	1,892,044	3,909,050
8045	49HJ	1,407,103	691,764
8071	49HL	0	0
8001	49MD	690,766	0

Including reporting as well as supporting OAC/OBAN dollars would not completely solve this problem, however. Communications costs would still be understated for non-AFCC organizations, since AFCC would neither be a reporting nor supporting OAC/OBAN for these organizations. Any communications costs paid by AFCC will not be reported for these organizations, as the AFCC OAC/OBAN containing these costs will not be in the OAC/OBAN Table. A worldwide COM cost per mission person as suggested in Desmatics Technical Report No. 118-5 [18] would eliminate this understatement of costs.

4. Some OAC/OBANs had no costs whatsoever in FY83. This could be due to the fact that OAC/OBANs change over time, that the tables may not have been accurately updated, or that the MAJCOMs may not have been aware of the fiscal year of interest.
5. Another problem not addressed by the current reporting and supporting OAC/OBAN methodology is the one of multiple GELOCs per PAS. If a particular PAS is located at several bases, it follows that there would actually be more than one supporting OAC/OBAN. This fact cannot be reflected in the current system structure.
6. The current C-E O&S Cost Expenditure file is much larger than necessary. Records are currently accumulated over both CAIG cost elements and RC/CCs. The RC/CC is irrelevant so there is no need to accumulate costs over this code. The EEIC field in this file is also not used.
7. TDY and Fuel costs are now selected on a match with the reporting OAC/OBAN only. Desmatics has found fuel costs with C-E PECs and RC/CCs (Responsibility Center/Cost Centers) in the host OAC/OBANs, however. These records also contain a "9" in position 1 of the RC/CC codes indicating host-funded support of a tenant organization [13]. The current structure of the C-E system does not take these costs into account.
8. There are a number of OAC/OBANs in the Unit Factor Table which are not included in the OAC/OBAN Table. The organizations with these OAC/OBANs will not be completely costed as a result. The following PASs have

OAC/OBANs in the Unit Factor Table, but not in the OAC/OBAN table for FY83:

ATOSFYCZ	LUOYFVP7
AXOYFFRK	LWOYFFKN
BDOYFFTW	LYOSFH49
CCOYFZ4N	MPOSFH5C
EDOTFFC9	MWOSFH5F
EDOYF2QJ	NJOSFH5D
EEOTFD9V	ODOSFH46
EHOYFFNL	OPOSFZB0
EPOSFH48	PEOUFVXP
EPOYFBFX	RFOSFV6K
EPOYFFS0	RPODFBR5
EPOYFFS5	RXOSFH5G
GWOSFH5J	WEOSFH5H
LSOYFYX	WZOSFH47

There are also OAC/OBANs in the OAC/OBAN Table which are not in the Unit Factor Table. This only generates extra processing in the system.

Recommendations:

1. BOS and COM processing should be changed to develop a worldwide average cost per mission person, as outlined in Desmatics Technical Report No. 118-5 [18]. This method solves the problems associated with the current process of collecting BOS and COM costs. A worldwide cost per mission person would also eliminate the need to collect supporting OAC/OBANs. This would be desirable, since this information is not as readily available from the MAJCOMs as is the reporting OAC/OBAN of an organization.
2. Costs for the O&S Cost Expenditure File should be summed over OAC/OBAN and cost element code only. The file will then contain fewer records with no

loss of information. The RC/CC and EEIC fields are unnecessary to this file and should be removed.

3. The processing of BOS costs for the O&S Cost Expenditure File should be eliminated. This processing is unnecessary since costs in the Average Cost File are used for BOS cost computations.
4. The Office of VAMOSC should ensure that the OAC/OBANs in the Unit Factor Table and the reporting OAC/OBANs in the OAC/OBAN Table are identical.
5. The current selection criteria for Fuel and TDY should be reviewed. It is possible that all relevant costs are currently not included.

G. COST OUTPUT FILE

In Program G1 - Cost Output File, the information in the Unit Work File, O&S Cost Expenditure File, Average Cost File, and the Worldwide Allocation Factors file is combined and allocated to individual TMSs. Costs input to this program are at the worldwide, OAC/OBAN, organization, or TMS level. Costs in the Cost Output File are at the TMS level.

Program G1 is the last major processing done in this work unit. Costs allocated in this program to individual TMSs for the categories of Operations, Administrative, and Supply Support Personnel, Fuel, Utilities, BOS, RPM, COM, TDY, PCS and Medical are summed in Work Unit AX across all TMSs worldwide in order to produce the C-E system products. In this section Desmatics examines

the various allocations done in Program G1.

Procedure:

1. Desmatics allocated the General Depot Support costs in the O&S Cost Expenditure File to end items using the Worldwide TMS Allocation Factors in the Worldwide Allocation Factors file. These costs were then compared with the ones for General Depot Support in the C-E system Cost Output File.
2. Desmatics duplicated the allocation of Operations, Administrative, Supply Support, Medical, PCS, Utilities, and RPM costs from information contained in the Unit Work File. Operations Personnel and the associated Medical and PCS costs were allocated using the Operator Factor. Administrative and Supply Support Personnel, their associated Medical and PCS costs, and RPM costs were allocated using the Unit TMS Allocation Factors in the Unit Work File. Because Utility costs were calculated at the TMS level in Program C5 - Unit TMS Data File, no allocations were used in Program G1. The results of Desmatics' allocations were then compared with the costs for these cost elements in the C-E system Cost Output File.
3. The average cost per person in the Average Cost File was multiplied by the total number of personnel at a PAS and then by the Unit TMS Allocation Factor in order to compute BOS costs at the TMS level. These costs were then compared with the BOS cost elements in the Cost Output File.

4. The processing of the cost elements of COM, TDY, and Fuel was also duplicated. Communications costs in the O&S Cost Expenditure File were matched by OAC/OBAN to the Unit Work File. On a match these costs were multiplied by the Base Communications Factor and then by the Unit TMS Allocation Factors to get COM costs by TMS.

TDY and Fuel costs in the O&S Cost Expenditure File, which are at the OAC/OBAN level, must first be allocated to organizations, and then to individual TMSs at those organizations. To allocate costs to the organizations in an OAC/OBAN, a PAS Allocation Factor, which relates the total number of personnel at a PAS to the total number of personnel at all PASs within that OAC/OBAN, was computed.

After multiplying the costs in the O&S Cost Expenditure File by the PAS Allocation Factor, TDY costs were allocated to TMSs using the Unit TMS Allocation Factor. Fuel costs were allocated to TMSs using the Fuel Factor. These costs, and the costs computed for COM, were then compared to those in the C-E Cost Output File.

Files Used:

Unit Work File - PJMF2AO (Format DIGSOP PJUWF)
O&S Cost Expenditure File - PJME1AO (Format DIGSOP PJOSCEF)
Worldwide Allocation Factors - PJMC5B0 (Format PJWWAFT)
Average Cost File - PJME1CO
Cost Output File - PJMG1AO (Format DIGSOP PJCOF)

Results:

1. General Depot Support costs computed by Desmatics were identical to those in the Cost Output File.

2. Operations, Administrative, Supply Support, Medical, PCS, RPM and Utilities costs were identical to those in the Cost Output File.

It should be noted, however, that very few TMSs had Operations Personnel costs because most Operator Factors for FY83 were zero. Desmatics looked at the system tutorials for Work Unit YF and found that whenever a Fuel Factor is generated, the Operator Factor for that TMS is changed to zero. There seems to be no logical reason why a TMS could not require an operator and consume fuel at the same time.

3. The BOS costs calculated using the Average Cost File and the Unit Work File were identical to those in the C-E Cost Output File.

4. The COM costs calculated by Desmatics were equivalent to those in the Cost Output File in about 85% of the cases. The remaining cost records fell into two categories: PASSs with no Base Communications Factor, and PASSs which were allocated no costs even though costs for their OAC/OBAN, a Base Communications Factor, and Unit TMS Allocation Factors were all present.

In the first category where there was no Base Communications Factor input in the Unit Factor Table (three PASSs in the Unit Work File), costs were

overallocated by a substantial amount. For example, PAS ATOYFFMK had an OAC/OBAN of 49SR and no Base Communications Factor in the FY83 Unit Work File. There were approximately \$1 million dollars in COM costs for this OAC/OBAN in the O&S Cost Expenditure File. Since there was no Base Communications Factor, one would expect no costs to be allocated to the TMSs owned by this PAS. However, each of 26 TMSs at the PAS was allocated anywhere from \$9,000 to \$11,000,000 in COM costs, with the average being about \$750,000 per TMS. The total allocated for this OAC/OBAN substantially exceeded the \$1 million expended. Desmatics could find no apparent reason for these figures. However, if each PAS in the Unit Factor Table is given a Base Communications Factor these overallocations should not occur.

In the second category where COM costs differed (22 PASSs), the C-E system allocated no costs to any of the TMSs with the following OAC/OBANS:

<u>OAC/OBAN</u>	<u>Total COM Expenditure</u>
4603	\$1,444,161
4616	\$326,034
4618	\$690,765
4622	\$1,154,165
4648	\$1,327,743
4649	\$987,281
4688	\$1,308,337
49CH	\$2,646,090
49CX	\$1,136,045
49DF	\$21,013
49DP	\$519,225
49MC	\$3,314,498
49RE	\$849,411
49RJ	\$745,814
49SC	\$319,321
49SW	\$648,587
49TB	\$3,791,827
7880	\$648,380

Desmatics could find no explanation for this as these TMSs had Unit TMS Allocation Factors, the PASs had Base Communications Factors, and the OAC/OBANs contained costs in the O&S Cost Expenditure file for the COM cost element.

5. TDY and Fuel Costs computed by the C-E system did not match those computed by Desmatics. There are at least three distinct problems with the allocation of these costs. First, TDY and Fuel are being calculated in the same manner when the Unit TMS Allocation Factor should be used to allocate TDY costs, and the Fuel Factor should be used to allocate Fuel costs. Apparently, the Fuel Factor is not being used by the C-E system at all.

Secondly, when processing TDY or Fuel costs, the same dollar amount for that cost element is being allocated to each TMS at an OAC/OBAN. It is not clear how this dollar amount is calculated. When there is one PAS per OAC/OBAN it seems as if the Unit TMS Allocation Factor is applied once and then the resulting dollar figure is carried through the entire OAC/OBAN.

For example, OAC/OBAN 4612 includes only PAS RPOUFFF's. The Fuel cost in the O&S Cost Expenditure File for this OAC/OBAN is \$912. Due to processing problems in Program C5, each TMS in this PAS received a Unit TMS Allocation Factor of .00637. Each TMS in this PAS also received \$- in Fuel costs, which is equivalent to \$912 multiplied by .00637. Even when the allocation factors for the TMSs are different, the same dollar amount is still allocated to each TMS at the OAC/OBAN. This dollar amount

results from multiplying the cost by the Unit TMS Allocation Factor for one TMS at the OAC/OBAN.

When there is more than one PAS per OAC/OBAN the PAS Allocation Factor does not appear to be working correctly. The same dollar amount is still being allocated to each TMS at the OAC/OBAN, but Desmatics cannot determine how this amount is calculated.

A third problem with the allocation of TDY and Fuel costs is that the entire expenditure for the OAC/OBAN is not always allocated. It appears that the costs for TDY or Fuel are not always being summed correctly over Cost Element Code in the O&S Cost Expenditure File before the allocation factor is applied. Again using OAC/OBAN 4612 and PAS RPOUFFF5 as an example, each TMS was allocated \$129 in TDY costs. The O&S Cost Expenditure File contains three TDY records for this OAC/OBAN. The records contain \$11240, \$62573, and \$8969 each for a TDY total of \$82782. Multiplying this total by the Unit TMS Allocation Factor of .00637 results in a TDY cost of \$527 for each TMS, not \$129. However, if only two of the three TDY records are taken into consideration (\$11240 and \$8969), the allocated TDY cost is \$129.

There are instances in the Cost Output File when it seems as if all cost records, no cost records or any number in between are used to allocate TDY or Fuel costs to end items. If the records in the O&S Cost Expenditure File were accumulated over Cost Element Code, instead of Cost Element Code and RC/CC in Program E1, summing over cost element would be unnecessary in

Program G1.

The inaccurate summation over cost element may also explain why no COM costs were allocated to TMSs with certain OAC/OBANS. Summation over cost element code is done at the same point in Program G1 for TDY, Fuel and COM costs.

6. The system tutorials for this program indicate that a record may be rejected if there is a Unit Work File record, but no corresponding O&S Cost Expenditure Record. This, however, does not seem to be the case. Many records in the Cost Output File which did not have corresponding entries in the O&S Cost Expenditure File (e.g., PASSs with OAC/OBANS in the Unit Factor Table, but not in the OAC/OBAN Table) were not rejected from this program.

The information about these PASSs which does not depend upon costs at the OAC/OBAN level in the O&S Cost Expenditure File (all cost elements except TDY, COM, and Fuel) should not be rejected at this point. Entries for COM, TDY, and Fuel for these PASSs will be zero in the Cost Output File, however, and should be rejected in order to indicate incomplete costing of these PASSs. These rejects should not occur if the OAC/OBANS in the Unit Factor Table match those in the OAC/OBAN Table, unless the OAC/OBANS in either table are incorrect.

Recommendations:

1. The Office of VAMOSC should look into the problems with Program G1 which are causing COM, Fuel, and TDY costs to be misallocated, and remedy them.
2. Program G1 should print out a reject listing for those TMSs with cost elements dependent on missing information in the O&S Cost Expenditure File. In this way the Office of VAMOSC will be alerted to any PASSs and TMSs with incomplete costing.
3. The updating of the Unit TMS Factor Table currently done in Work Unit YF should be examined. A TMS should be able to have both Operations Personnel and Fuel costs.

H. TPN019V, TPS043E, AND TRC097A COSTING

It was Desmatics' original intention to compile cost reports for categories computed in this work unit for the TPN019V, TPS043E, and TRC097A as they would appear if the C-E system were working correctly. However, because of the number and compounding of programming errors in this work unit, it was not feasible to do this.

Desmatics did, however, compile costs for these TMSs based on information available in the C-E system but thrown out before final costing. In this section Desmatics presents a comparison of the FY83 costs on the O&S Cost Reports and those which would have been on the reports if no PASSs had been

rejected in Program F2.

The costs compiled by Desmatics reflect a Unit Factor Table and Base Utility Rate File which contain all PASs and GELOCs in the PAS-ORG Table. These are small changes which only require the Office of VAMOSC to update these files. However, as can be seen in Figures 3 through 5, these changes make a large difference in the outcome of these reports.

Note that "Costed Inventory" in the following reports refers to the cost categories listed, and "TMS Total" refers to the costs for all 19 cost categories of the C-E system. It is important to keep in mind that these costs still reflect the processing problems with the Unit TMS Allocation Factors, Utilities costs, RPM costs, etc., so actual costs for these TMSs may be significantly different.

TPN019V

	<u>FY83 C-E COST REPORT</u>	<u>FY83 REPORT WITH REJECTS</u>	<u>DIFFERENCE</u>
Operations	\$0	\$0	\$0
Administration	\$110,213	\$324,201	\$213,988
Supply Support	\$41,533	\$111,228	\$69,695
* Fuel	\$93	\$0	(\$93)
Utilities	\$0	\$11,199	\$11,199
BOS	\$266,047	\$673,137	\$407,090
RPM	\$5,038	\$212,597	\$207,559
* COM	\$12	\$3,525	\$3,513
* TDY	\$78,858	\$211,030	\$132,172
Medical	\$7,947	\$16,869	\$8,922
PCS	\$13,382	\$43,822	\$30,440
Subtotal	-----	-----	-----
TMS Total	\$523,123	\$1,607,608	\$1,084,485
Costed Inventory	6	8	
Format 50 Inventory	10		

* When calculating the FY83 costs including PASs which had been rejected in Program F2, Desmatics could not duplicate the C-E system errors involved in processing these categories. If Program G1 were working as intended, the FY83 C-E Cost Report would have shown the following costs:

Fuel	\$0
COM	\$3,525
TDY	\$79,065

Figure 3: O&S Cost Reports for the TPN019V

TPS043E

	<u>FY83 C-E COST REPORT</u>	<u>FY83 REPORT WITH REJECTS</u>	<u>DIFFERENCE</u>
Operations	\$0	\$0	\$0
Administration	\$233,654	\$1,497,474	\$1,263,820
Supply Support	\$44,038	\$280,715	\$236,677
* Fuel	\$654	\$0	(\$654)
Utilities	\$79,506	\$711,074	\$631,568
BOS	\$111,760	\$1,432,075	\$1,320,315
RPM	\$33,437	\$273,158	\$239,721
* COM	\$4,590	\$8,564	\$3,974
* TDY	\$4,946	\$136,120	\$131,174
Medical	\$28,384	\$81,654	\$53,270
PCS	\$60,927	\$173,660	\$112,733
Subtotal	----- \$601,896	----- \$4,594,494	----- \$3,992,598
TMS Total	\$10,270,432	\$14,263,030	\$3,992,598
Costed Inventory	2	27	
Format 50 Inventory	54		

* When calculating the FY83 costs including PASs which had been rejected in Program F2, Desmatics could not duplicate the C-E system errors involved in processing these categories. If Program G1 were working as intended, the FY83 C-E Cost Report would have shown the following costs:

Fuel	\$0
COM	\$4,590
TDY	\$82,495

Figure 4: O&S Cost Reports for the TPS043E

TRC097A

	<u>FY83 C-E COST REPORT</u>	<u>FY83 REPORT WITH REJECTS</u>	<u>DIFFERENCE</u>
Operations	\$0	\$0	\$0
Administration	\$239,460	\$1,337,342	\$1,097,882
Supply Support	\$86,585	\$347,542	\$260,957
* Fuel	\$930	\$0	(\$930)
Utilities	\$50,644	\$388,608	\$337,964
BOJ	\$446,713	\$1,879,068	\$1,432,355
RPM	\$34,086	\$386,176	\$352,090
* COM	\$752	\$11,509	\$10,757
* TDY	\$85,360	\$239,884	\$154,524
Medical	\$75,404	\$122,727	\$47,323
PCS	\$227,200	\$332,795	\$105,595
Subtotal	----- \$1,247,134	----- \$5,045,651	----- \$3,798,517
TMS Total	\$9,760,846	\$13,559,363	\$3,798,517
Costed Inventory	25	179	
Format 50 Inventory	335		

* When calculating the FY83 costs including PASs which had been rejected in Program F2, Desmatics could not duplicate the C-E system errors involved in processing these categories. If Program G1 were working as intended, the FY83 C-E Cost Report would have shown the following costs:

Fuel	\$0
COM	\$752
TDY	\$118,360

Figure 5: O&S Cost Reports for the TRC097A

IV. WORK UNIT AX

Work unit AX produces two files: the C-E O&S Cost Report File (PJMH3A0), and the Ranking Work File (PJMH3C0). It consists of only one program, H3 - Build History File. In this section Desmatics examines the processing in Program H3, and discusses the validity of comments added to O&S cost reports to indicate incomplete costing of TMSs. These comments are generated in Work Unit DA, and an option exists in Program H3 to add these comments to the O&S Cost Reports.

A. HISTORY FILE

Program H3 aggregates O&S costs for TMSs to the worldwide level, and generates the C-E O&S Cost Reports and the Ranking Work File. In addition, in this program the Office of VAMOSC can add any input data availability comments from the Comments File (PJMCVA0) to the O&S Cost Reports. Other inputs to H3 are the Maintenance Cost File (PJMX1A0) from Work Unit EX, the Cost Output File (PJMG1A0) from Work Unit AN, and the Engineering Cost File (PJMA3H0) which is developed by the Office of VAMOSC.

Procedure:

1. Desmatics duplicated the functions of Program H3 in Work Unit AX to produce the FY83 C-E O&S Cost Reports. The addition of data availability comments and the production of the Ranking Work File were not included in

the Desmatics program. In addition, Desmatics did not screen its history file against the TMS-NSN Table as is done in the C-E system processing.

2. The reports generated by Desmatics were compared to those produced by the C-E system for FY83.

Files Used:

Maintenance Cost File (Table 8) - PJMH1AO, (Format DIGSOP PJTAB06)
Engineering Cost File - PJMA3H0, (Format DIGSOP PJENCST)
Cost Output File - PJMG1AO, (Format DIGSOP PJCOF)

Results:

1. The O&S Cost Reports created by Desmatics generally agreed with the FY83 reports generated by the C-E system. However, there were discrepancies between the Desmatics and C-E reports in the Medical and PCS costs for all items with reported operator costs (5 TMSs). These costs for the two sets of FY83 products are given in the following table:

TMS	Desmatics		C-E	
	Medical	PCS	Medical	PCS
BBH160RS	\$ 6,017	\$ 25,040	\$ 137	\$ 232
FSC031	86,020	178,860	13,848	18,219
FSC076	76,067	166,860	3,895	6,922
GGC15V6	14,543	49,174	523	1,127
MSQ077	11,254	28,664	10,740	28,664

An examination of the input files indicated that the Medical and PCS costs computed by Desmatics for these five TMSs were, in fact, what should have been produced by Program H3. All other costs generated by Desmatics

agreed with those on the FY83 C-E reports.

It was determined that the discrepancies listed in the table above were caused by the failure of Program H3 to add the Medical and PCS costs for records from the Cost Output File with a CAIG cost element of 301.10 to the total Medical and PCS costs. Records with CAIG cost element 301.10 contain the Medical and PCS costs for Operations Personnel.

2. The history file created by the Desmatics program contained six TMSs which were not on the FY83 TMS-NSN Table. These were traced to the Engineering Cost File which is input to the C-E system by the Office of VAMOSC. This is the only input to the history file which is not screened against the TMS-NSN Table at some point prior to this in the C-E system processing.

Recommendations:

1. Program H3 should be modified so that Medical and PCS costs for CAIG cost element 301.10 are included in the total costs for the respective cost categories.
2. In generating the Engineering Cost File, the Office of VAMOSC should not include items which are not in the TMS-NSN Table. In conjunction with this, the processing step in which the history file is screened against the TMS-NSN Table would no longer be necessary, and should be eliminated.

B. DATA AVAILABILITY COMMENTS

The main function of Program H3 is to produce the O&S cost reports. There is also an option in this program for adding comments on input data availability to the reports. The comments, which indicate that data for the TMS is not reported in one or more input systems, are used to alert users of the C-E data to incomplete costing of TMSs. The data availability reports containing these comments are generated in Work Unit DA where the following input systems are screened for information about TMSs on the TMS-NSN Table:

<u>System</u>	<u>Information Provided</u>	<u>Data Screened</u>
D039	End item inventory, Format 50 records	NIIN
D041A	Recoverable-application pairs	Application NIIN
D056A	Base labor hours by SRD	SRD
0013	Item packaged weight	NIIN

The first program in Work Unit DA is D5, Build Availability File. This program creates the availability matrix from the TMS-NSN Table, and checks for the presence of data in D056A by matching SRDs in the TMS-NSN Table and the twelfth month Base Labor File (PJM2A1) from Work Unit M1. The remaining programs successively check for data for the TMSs in the 0013, D039, and D041A files by matching the NIIN of the TMS with the NIINs of all reported items in each system. For the D041A data, the NIIN checked is that of the (next higher) application for each recoverable-application pair. In each case, absence of data for a TMS causes the availability file to be updated. Below is the list of data availability comments generated by Work Unit DA, and the cost categories which could be affected by a lack of data for a TMS in the indicated system.

<u>Data Availability Comment</u>	<u>Cost Categories Affected</u>
Not in D039	All <u>except</u> Base Maintenance Personnel Maintenance Material Engineering Support
Not in D041	Depot Maintenance Replacement Investment T&P
Not in D056	Base Maintenance Personnel
Not in 0013	T&P

Procedure:

1. Desmatics examined the descriptions of the five programs in Work Unit DA in the system tutorials prepared by personnel in HQ AFLC/LMVRW, and had discussions about this work unit with these personnel.
2. Desmatics also examined microfiche copies of a number of the FY83 C-E O&S Cost Reports which had data availability comments added by Program H3.

Results:

1. A "Not in D039" comment reflects an absence of the TMS in that system's Format 50 records. These records report the worldwide inventory for a TMS; the C-E system uses a four-quarter average of these reported inventories for normalizing costs. In processing costs, the C-E System also uses D039 Format 100 records. These latter records, which contain inventories by organization, are not screened for data availability. Since it is possible for an item to have no reported inventory in Format 100 records and show a positive inventory in the Format 50 records, and

vice versa, these comments can be misleading.

As recommended in a previous section, Desmatics believes TMSs not in the D039 system should not be costed by the C-E system. Because sixteen of the nineteen cost categories depend on information from D039, the C-E system cannot produce meaningful reports for items not reported in this system.

2. When applied to D041A data, the screening method in Work Unit DA can only find first level master recoverables for an end item. A "Not in D041" comment resulting from this type of screen means either that the item has no recoverables, or that the item's first level recoverables are not in D041A. For items with no recoverables, such comments would not indicate incomplete costing. The presence or absence of data for recoverables below the first level can not be checked using this method. Comments relating to the D041 system, as currently generated, can therefore be misleading.
3. Screening 0013 data only for end item NIINs is inappropriate. In most cases, recoverables are more likely to be shipped to the depot for repair than are end items, and their weights are equally necessary, if not more so, for complete costing of T&P. A "Not in 0013" comment will not necessarily reflect any lack of data necessary for computing T&P costs completely. Conversely, a TMS with recoverables not reported in 0013 may have incomplete T&P costing, but no comment to that effect.

4. For D056A data, the comment "Not in D056" means either that the item is not reportable in the system, or that no labor hours were reported for the item for that time period. The C-E System cannot compute Base Maintenance labor costs for items exempt from reporting in D056A. There is no way of distinguishing whether a lack of such costs on the O&S Cost Reports is due to this reporting exemption or simply due to a lack of reported maintenance for the period. Therefore, any comments relating to D056A data, as currently generated, are misleading to the user.
5. In some instances, comments appear to be inaccurately applied to reports. For example, there are cases in which an average annual inventory is reported for a TMS, yet the report contains a "Not in D039" message. According to personnel from LMVRW, these misapplied comments may be due to one or more programming errors.

Recommendation:

The procedures used to generate and apply data availability comments to the C-E O&S Cost Reports should be discontinued. As currently generated, such comments are misleading or inaccurate.

V. END ITEM INVENTORY CONSIDERATIONS

In order for the C-E O&S Cost reports to be meaningful, it is necessary that the costs displayed in each category of a report be based on the same number of end items. At present, the inventory on which costs are based varies from category to category. This section discusses the current status of this aspect of the system processing, and describes the changes necessary in order to have all categories portray costs for the same number of end items.

A. INVENTORY BASIS FOR REPORTED O&S COSTS

The Average Annual Inventory displayed on the C-E O&S Cost Reports is obtained from D039 Format 50 records; it represents the Air Force-wide inventory of the item, including that owned by ANG and AFRES units. This inventory figure is the one currently used to normalize all costs the C-E system provides.

The Average Annual Inventory is obtained by averaging four quarters of reported data from D039 Format 50 records. As mentioned previously, Desmatics observed unusual variations from quarter to quarter in this data which did not appear to be explainable by expected occurrences such as phase-ins or phase-outs of equipment. Also, inventories from these records often disagreed substantially with those from the Format 100 records used by the C-E system.

Format 100 inventories are obtained only from fourth quarter records.

As the C-E System is currently designed, only two cost categories, Engineering Support and Replacement Investment, are based on the Air Force-wide inventories from D039 Format 50 records. For Base Maintenance Personnel costs, the costed inventory is indeterminate because it can be affected by organizational labor hour reporting exemptions for some SRDs. All other costs are based either on the inventories of active duty units (all units Air Force-wide less ANG and AFRES units) or on the Format 100 inventories of organizations on the PAS-ORG Table. The C-E cost categories and the inventory actually costed by the system in each case are listed below:

<u>Cost Category</u>	<u>End Item Inventory Costed</u>
Operations Personnel	Unit TMS Data File*
Base Maintenance Personnel	Indeterminate
Administrative Personnel	Unit TMS Data File*
Supply Support Personnel	Unit TMS Data File*
Fuel	Unit TMS Data File*
Maintenance Material	Air Force-wide
Utilities	Unit TMS Data File*
Depot Maintenance	Partly Air Force-wide, partly Active duty
Replacement Investment	Air Force-wide
BOS	Unit TMS Data File*
RPM	Unit TMS Data File*
COM	Unit TMS Data File*
TDY	Unit TMS Data File*
PCS	Unit TMS Data File*
Medical	Unit TMS Data File*
Engineering Support	Air Force-wide
General Depot Support	Unit TMS Data File
T&P	Partly Air Force-wide, partly active duty

Currently the categories marked with an asterisk reflect the inventories in the Unit TMS Data File less those TMSS rejected from Program F2. If C-E input tables are properly updated as recommended in Section III, there should be no rejects from Program F2.

All costs on the C-E O&S Cost Reports should be based on the same inventory: the inventory of organizations in the PAS-ORG Table. This information is contained in the Unit TMS Data File (PJMCA50). It can be seen from the table above that if all records in this file were retained, twelve cost categories would be based on this inventory. Desmatics recommends adjusting costs in the remaining categories so that they also reflect the inventory in the Unit TMS Data File. This inventory figure should be displayed on the reports as costed inventory, and used for normalization of all costs on a report.

The Air Force-wide inventories on the O&S Cost Report should also be obtained from Format 100 records, instead of the Format 50 records currently used. Desmatics found a number of instances where the Air Force-wide Format 50 records showed an inventory for an item that was less than the sum of the quantities reported by all owning organizations on the Format 100 records. A few examples of these discrepancies are listed below:

<u>TMS</u>	<u>Format 50</u>	<u>Format 100</u>
FRA086	415.25	454
GSH062V	3.75	11
DD0008	0.00	52
TA312PT	0.00	1692
FTAG22	0.00	46

In the next section Desmatics outlines the changes required in the system processing in order to have all cost categories reflect the inventory in the Unit TMS Data File.

B. PROCESSING CHANGES FOR INDIVIDUAL COST CATEGORIES

In order to have all costs based on the same inventory, changes are required in the processing for those cost categories which do not currently reflect costs for the D039 Format 100 inventory in the Unit TMS Data File. These categories are: 1) Base Maintenance Personnel, 2) Maintenance Material, 3) Depot Maintenance, 4) Replacement Investment, 5) Engineering Support, and 6) T&P. Costs in some of these categories will require further allocation with one of two ratios:

$$P_i/A_i \text{ or } P_i/W_i$$

where P_i = quantity of TMS_i owned by organizations in the PAS-ORG Table (summed over the Unit TMS Data File, PJMC5AO),

A_i = quantity of TMS_i owned by active duty units (summed over D039 Format 100 records),

and W_i = quantity of TMS_i Air Force-wide (summed over D039 Format 100 records).

The first ratio will adjust any cost computed for the end item inventory of active duty units. The second ratio will similarly adjust costs computed for worldwide inventory levels. The processing changes required for the individual categories are described separately in the subsections below.

1. Base Maintenance Personnel

The allocation of base labor costs in the C-H system both organizational and end item reporting examples. For example, there are 29 SRDs in the FY87 TM - 1.

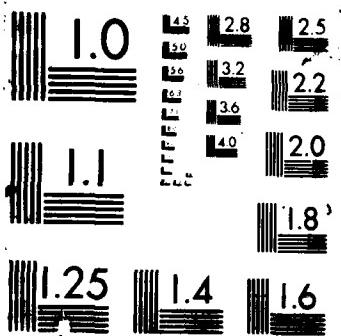
AD-A187 284 COMMUNICATIONS-ELECTRONICS (C-E) SYSTEM: DATA QUALITY 2/2
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labor hour reporting in this system [14]. These items are:

<u>SRD</u>	<u>TMS</u>	<u>SRD</u>	<u>TMS</u>	<u>SRD</u>	<u>TMS</u>
CDG	GSC039V1	41A	FPS050V	41M	FPS092
CDH	GSC039V2	41B	FPS049	41S	FSQ037
CQ1	R00390	41C	FLR014V	41T	FSA028
EVC	UPX014	41D	FSQ028	41U	FSA036
FEQ	R00002	41E	FSA027	41V	FSA092
JDC	FSC078V	41F	FSA041	41W	FSM027
JFJ	FA071V	41G	FSM021	41Y	FSQ052
JWF	GSH035	41H	FSQ051	41Z	FPA031
KHT	37ASR	41J	FPA020	42A	FPA021
KHY	M028ASR	41L	FPA025	42B	FPA024

If all other data is available for these items, the only category which could not be costed is Base Maintenance Personnel, and this could be so noted on reports for these items. In addition, there is at least one C-E organization with reporting exemptions for seven items which appear in the TMS-NSN Table [14]. This organization, the (SAC) 1st Combat Evaluation Group, consists of 24 separate PASs [12]; 14 of these are in the PAS-ORG Table. It is exempt from labor hour reporting for TMSs with the following SRDs: EBZ, EDM, EEB, EEU, EE3, EGB, and EVA. Organizations with labor hour reporting exemptions for costed items should probably not be included in the PAS-ORG Table. In costing Base Maintenance Personnel for SRDs with partial reporting exemptions, allowance should be made for the missing data for these items. This is discussed further below.

The numerator of the current Base Labor Allocation Factor consists of the total annual labor hours for a SRD as reported in D056A. The denominator is the product of the estimate of annual available duty hours for a maintenance person and the total number of personnel with a given AFSC as summed from the Personnel Data File (PJMB3AO). The annual available duty hours figure used is a weighted average, as computed by the Office of VAMOSC, of the average

available hours for CONUS and overseas AFCC maintenance personnel.

For the immediate term, the total number of personnel with a given AFSC in the denominator of the Base Labor Allocation Factor should be the worldwide total for the AFSC as obtained from the MPC input files to the VAMOH system. The Personnel Data File, which is matched to worldwide hours, currently only contains a subset of the VAMOH MPC data. The Personnel Data File must also be screened against the PAS-ORG Table, so that the allocated dollars reflect the correct inventory figures.

The implicit assumption underlying the current Base Labor Allocation Factor is that there is a direct relationship between maintenance AFSCs and SRDs, i.e., that an AFSC is responsible for maintaining one or more specified SRDs, and those SRDs only. This assumption is not necessarily valid. In discussions with AF maintenance personnel, Desmatics has learned that it is also likely that several AFSCs will work on a given SRD. For this reason, the factor should be replaced.

Desmatics suggests an alternate algorithm for allocating Base Maintenance Personnel costs. This algorithm is not based on the assumption of a direct relationship between an AFSC and certain SRDs, and costs the correct end item inventory provided no organizations with labor hour reporting exemptions for items in the TMS-NSN Table are included in the PAS-ORG Table. This method, which is based on an average cost per maintenance hour for C-E personnel, is described below.

If the worldwide Base Maintenance Personnel cost for any TMS_i costed by

C-E is defined as B_i , this cost can be computed as follows:

$$B_i = H_i \times M \times P_i / R_i$$

where H_i = annual reported labor hours for all SRDs for TMS_i, from D056A,

M = average hourly cost for a C-E maintenance person,

P_i = quantity of TMS_i owned by organizations in the PAS-ORG Table (summed over the Unit TMS Data File, PJMC5AO),

and R_i = quantity of TMS_i Air Force-wide less inventory of organizations with D056A reporting exemptions for TMS_i, from D039 Format 100 records.

The average cost per hour, M, for a C-E maintenance person can be represented by the following equation:

$$M = 1.18 \times C / (2080 \times N)$$

where C = total cost for all maintenance personnel in the Personnel Data File (PJMB3AO),

N = total number of maintenance personnel in the Personnel Data File (PJMB3AO),

2080 = total number of working hours per year [15],

and 1.18 = Acceleration Factor for standard composite pay rates for leave and holiday [15].

This allocation method, like the current one, allocates costs which have been accumulated to the worldwide level. It can, however, be modified to allocate costs to TMSs at the organizational level by substituting the organizational inventory of the TMS for P_i in the first equation above. In addition, the variables C and M in the second equation would have to be changed to the total cost for all maintenance personnel at the organization, and the total number of maintenance personnel assigned to the organization, respectively.

2. Maintenance Material

Base level maintenance material costs are obtained by SRD from the D002A system, and reflect worldwide inventory levels. For the short term, these could be allocated with the ratio P_i/W_i . However, this is not necessarily worthwhile because the data currently received from the interface with this system is incomplete. There is a programming error in this interface which cannot be corrected until a D002A system transition currently in progress is complete. Desmatics previously recommended changes to the processing of these costs which require a new interface to select complete costs correctly for the C-E system, and also to provide the organization codes reported in D002A. With a new field to relate these D002A organization codes to those in the PAS-ORG Table, selection and summarization of material costs can be limited to the inventory of C-E organizations costed by the system.

3. Depot Maintenance

Selection of input cost data from the H036B system for Depot Maintenance is currently restricted to items from active duty organizations. For the short term, this portion of the total depot maintenance costs can be adjusted with the ratio P_i/A_i to limit costing to the inventory of units in the PAS-ORG Table. Implementation of a new method previously recommended by Desmatics [19] for computing Depot Maintenance costs based on NRTS (Not Repairable this Station) actions identified to organizations in the PAS-ORG Table will restrict computation of these costs to the inventory of these organizations.

Costs for the Mobile Depot Maintenance portion of Depot Maintenance are obtained from the C003K system. They are identified only to SRD and represent worldwide inventories. They can be allocated with the ratio P_i/W_i .

4. Replacement Investment

For the immediate term, Replacement Investment costs, which are for worldwide inventories, can be adjusted with the ratio P_i/W_i . Implementation of the alternate method previously recommended by Desmatics [19] will restrict computation of these costs to items owned by organizations in the PAS-ORG Table.

5. Engineering Support

Engineering Support costs are obtained at the system level for Air Force-wide inventories. After allocation of these costs to the various end items composing a system, the costs for each item must be further allocated with the ratio P_i/W_i so that they reflect the costs for items owned by organizations in the PAS-ORG Table.

6. T & P

For the immediate term, T&P costs for both depot and base level condemnations, which are based on worldwide inventories, can be allocated with the ratio P_i/W_i . For the costs in this category related to depot repairs, which are based on active duty inventories, the ratio P_i/A_i can be used.

A revised algorithm for SDT (Second Destination Transportation) costs has been approved for implementation in the WSSC and C-E Systems [20]. These SDT costs will be equivalent to the T&P costs currently calculated by the C-E system. The algorithm will be processed in the VAMOH preprocessor system, and SDT costs computed at the SRD level for items owned by active duty units will be passed to the C-E system. To represent costs for the inventory of units in the PAS-ORG Table, these computed costs will have to be further allocated with the ratio P_i/A_i .

VI. EFFICIENCY OF C-E SYSTEM PROCESSING

Desmatics believes that C-E system processing could be streamlined significantly. Currently, there is much extra volume and unnecessary processing in the C-E system. Four main factors contribute to this, and they are discussed in this section.

First, costs and other information are accumulated to unnecessary levels of detail only to be rolled up in later system processing. For example, RC/CCs are carried throughout the system when this level of detail is never utilized. Base Maintenance Personnel are accumulated by PAS, FAC, and AFSC, when they are costed at the AFSC level regardless of PAS or FAC.

A second factor which contributes to system inefficiency is the practice of leaving in program code, fields, and files which no longer serve any purpose. When a cost algorithm or some other aspect of system processing is changed, the old method should be eliminated from the system. Leaving this processing intact not only adds unnecessary volume, but it obscures the true workings of the C-E system.

Another problem area is system processing done against large input files which have not been screened against the TMS-NSN Table or the PAS-ORG Table. This creates unnecessary volume in the instances where files are later screened against these tables. Wherever possible, large data files should be screened against the appropriate tables prior to the processing for specific cost categories. For example, personnel processing should first be screened against the PAS-ORG Table.

A fourth factor adding unnecessary volume to the system is the duplication of some program functions. For example, SRD cards are used to exclude some base labor hours for TMSs not on the table. However, in later processing these labor hours are screened directly against the SRDs on the TMS-NSN Table, resulting in a duplication of effort. Another example involves the accumulation of personnel for like FAC, AFSC, Grade, PAS and GELOC in Program B3. This processing is also done by VAMOH before it passes the MPC Extract to the C-E system.

In general, the C-E system is much larger and more complex than is necessary. Wherever possible, programs should be checked for the above occurrences and streamlined. Streamlining the system would also allow for easier error checking and data quality monitoring.

VII. SUMMARY

This report has presented the results of a study conducted by Desmatics to assess the quality of the C-E system products. The study focused on identifying anomalous data in these products, and tracing the source of these anomalies in order to correct them.

Three major work units (AN, EX, and AX) were chosen for intensive study. To the extent practicable, the processing in these work units was duplicated by Desmatics using FY83 input data provided by the Office of VAMOSC. The intermediate and final files produced by Desmatics were compared with the corresponding ones generated by the C-E system for FY83. Desmatics was able to provide explanations for most of the discrepancies noted between the two sets of data.

The problems uncovered by this study originate from a number of different sources. Among the primary sources are:

- 1) inappropriate or incomplete input data, 2) incorrect assumptions about input data, 3) inadequate maintenance of manual inputs between fiscal years, 4) incorrect programming of allocation algorithms, and 5) programming errors.

Desmatics has suggested corrections to the current system processing which would provide solutions for the majority of the problems identified. However, some of these solutions are not optimal. In some cases, as recommended in previous Desmatics studies, alternate data sources should be used or alternate algorithms should be implemented. In this report Desmatics has recommended further essential modifications to some algorithms to ensure that all cost categories are based on the same end item inventory.

Desmatics has also determined that it is possible to simplify the C-E system considerably, and has suggested a number of processing changes which should reduce substantially the volume of data processed. These changes should result in a marked improvement in the efficiency of the system as a whole.

In Desmatics' opinion, methodically correcting all the errors in the current mode of processing is not the optimal approach to improving the quality of the C-E system products. Rather, the Office of VAMOSC should implement those changes which would improve the system products for the long term. Ideally, because of the interrelationships among them, these changes should be accomplished as a whole, rather than piecemeal. This approach should provide the greatest improvement in the quality of the C-E system products.

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APPENDIX

The following four pages contain part of the existing Unmatched PAS Reject Notice from Program F2, and an example of how Desmatics recommends that this notice be redesigned.

AMOSC

PERSONNEL DATA UNMATCHED PAS REJECT NOTICE
AS OF: 09-30-83

01-15-85 Q-D160A-F2A-AN

S CODES FOR:	UNIT FACTOR TABLE	TOTAL PAS PERSONNEL	PERSONNEL DATA FILE	REAL PROP MAINT	UNIT TMS DATA FILE	MESSAGE
****		1B0HFGR3				
****		1B0YFJKS				
****		7S34F33Z				
****		AFOTFDDBC				
****		AFOUF4RY				
****		AFOYF4DF				
****		AFOVF4DF				
****			1B0HFGR3			
****			1B0HFGR3			
****			1B0HFGR3			
****			1B0YFJKS			
****			1B0YFJKS			
****			1B0YFJKS			
****			7S34F33Z			
****			7S34F33Z			
****			7S34F33Z			
****			AFOTFDDBC			
****			AFOTFDDBC			
****			AFOTFDDBC			
****			AFOUF4RY			
****			AFOUF4RY			
****			AFOUF4RY			
****			AFOUF4RY			

Current Reject Notice (p.1 of 3)

CODES FOR:	UNIT FACTOR TABLE	TOTAL PMS PERSONNEL	PERSONNEL DATA FILE	REAL PROP MAINT	UNIT TMS DATA FILE	MESSAGE
	****		AF0UF4RY			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0YF4DF			
	****		AF0UF4RY			
	****			AF0UF4RV		
AF0VFFJ0						TOT PMS PERS < DATA PERS
	****		AF0VFFJ0			
	****		AF0VFFJ0			
	****		AF0VFFJ0			
	****		AF0VFFJ0			
	****		AF0VFFJ0			
	****		AF0VFFJ0			
	****		AHODF41H			
	****		AHODFB1H			
	****		AHODFB1R			
	****		AHODFB1R			
	****		AHODFB1V			
	****		AHOOFSGC			
	****		AHODFY48			
	****		AHOUF2XS			

Current Reject Notice (p.2 of 3)

WOSC

PERSONNEL DATA UNMATCHED PAS REJECT NOTICE
AS OF: 09-30-83

01-15-85 Q-D160A-F2A-AM

CODES FOR:	UNIT FACTOR TABLE	TOTAL PAS PERSONNEL	PERSONNEL DATA FILE	REAL PROP MAINT	UNIT TMS DATA FILE	MESSAGE
****		1B0HFGR3				
****		1B0YFJKS				
****		7S34F33Z				
****		AFOTFD8C				
****		AF0UF4RY				
****		AF0VF4DF				
****		AF0VF4DF				
****			1B0HFGR3			
****			1B0HFGR3			
****			1B0HFGR3			
****			1B0YFJKS			
****			1B0YFJKS			
****			1B0YFJKS			
****			7S34F33Z			
****			7S34F33Z			
****			7S34F33Z			
****			7S34F33Z			
****			AFOTFD8C			
****			AFOTFD8C			
****			AFOTFD8C			
****			AF0UF4RY			
****			AF0UF4RY			
****			AF0UF4RY			
****			AF0UF4RY			

Current Reject Notice (p. 3 of 3)

Personnel Data Unmatched PAS Reject Notice

PAS CODES FOR:

Unit Factor Table	Total PAS Personnel	Personnel Data File	PAS-RPM File	Unit TMS Data File	Message
****	1BOHFGR3	1BOHFGR3	****	****	
****	1BOYFJKS	1BOYFJKS	****	****	
****	7534F332	7534F332	****	****	
****	AFOTFDBC	AFOTFDBC	****	****	
****	AFOUF4RY	AFOUF4RY	AFOUF4RY AFOUF4RY		
****	AFOYF4DF	AFOYF4DF	****	****	
AFOYFFJO	AFOYFFJO	AFOYFFJO	AFOYFFJO AFOYFFJO	Total PAS < Per. Data	
****	AHODFB1H	AHODFB1H	****	****	
****	AHODFB1R	AHODFB1R	****	****	
****	AHODFB1V	AHODFB1V	****	****	
****	AHODFSGC	AHODFSGC	****	****	
****	AHODFY48	AHODFY48	****	****	
****	AHOUF2XS	AHOUF2XS	****	****	

**** INDICATES MISSING

Suggested Format for Unmatched PAS Reject Notice
(Information is identical to that on Pages A1-A3)

END

DATE

FILMED

FEB.

1988